...IGHT, NOVEMBER 24, 1938 FIRST AERO WEEKLY IN THE WORLD REGD. AT THE G.P.O. AS A NEWSPAPER.

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...1561 ...XXXIV

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

The Priority Question

THE attitude taken up last week by *Flight* on the subject of giving priority to production of fighters has been justified by the speech of Sir Kingsley Wood at the Press Club, where he emphasised, as *Flight* had done, that his new policy did not mean any neglect of the bomber and of the counter-offensive. Some writers in the papers have concluded that such neglect was the implication of the Air Minister's announcement in the House on November 10. Sir Kingsley was probably responsible for this impression by using the words "The Prime Minister has already emphasised that our rearmament is essentially defensive." That phrase suggests that the counter-offensive was not to be regarded as part of our defensive strategy, but such a conclusion was erroneous. The possession of a large bomber force would not imply that Britain was contemplating any aggression on another country—only that the tactical offensive is a necessary part of strategic and political defence. We must be *able* to hit back in order to discourage anybody from first hitting us.

Fool's Mate

NONE the less, we have to contemplate the possibility of some Power attacking us in hopes of a lightning victory wrought by its existing first-line bombers. In such a case the enemy might think that victory would be achieved before there was much need for his own factories to replace the casualties to his aircraft, and so, perhaps, would be willing to contemplate the destruction of those factories by British bombers. To meet an attack of that sort, our first necessity must obviously be as complete an organisation as possible for dealing with the enemy bombers in the air—not in the factories. To use a chess term, we must guard against a fool's mate, a case in which a player is checkmated before he can even deploy his own forces.

Although we are convinced that no air attack on London will ever force Britain to sue for peace, we want to avert damage so far as possible, and therefore it is right to give priority to the supply of fighters and to increase the proportion of fighter squadrons in our Home defence force. The War Minister has already given priority to air defence weapons over other weapons needed by the Army, and it would be absurd if the Air Minister lagged behind his colleague in this matter.

Approaching the Limit?

NOT only the lecturer, but some of those who participated in the discussion of Dr. Seewald's paper last Thursday at the Royal Aeronautical Society took a somewhat gloomy view of the future when contemplating the possibility of further increases in aircraft speeds. The distinguished German scientist stated, and no one seriously challenged him, that it seemed possible to reduce the minimum drag of practical aeroplanes by about 30 per cent., which would give a speed increase of 10 per cent. Of the items which could contribute substantially towards this improvement, drag of radiators and engine nacelles appeared to be the most fruitful.

"In the course of the last ten years," the lecturer said, "a large portion of the possible aerodynamic improvement has already been carried out. So long as no basically new discovery in physical knowledge is made, which involves new possibilities, we must content ourselves with the steps in progress indicated above" (refer-

THE OUTLOOK (CONTINUED)

ring to the earlier part of the lecture).

Dr. Seewald did, it is true, admit afterwards that such a discovery *might* be found in connection with the control of the boundary layer, but was inclined to agree with Sir Henry Tizard that the prospects gave no cause for optimism.

High wing loading is often held to promise very considerable gains in cruising speed, and is now being made possible by the introduction of "assisted take-off" in some form or other. Dr. Seewald showed that investigations made at the DVL indicated that wing loading for maximum speed dropped rapidly with increasing altitude, but by sacrificing a certain amount of top speed a slightly greater wing loading could be used.

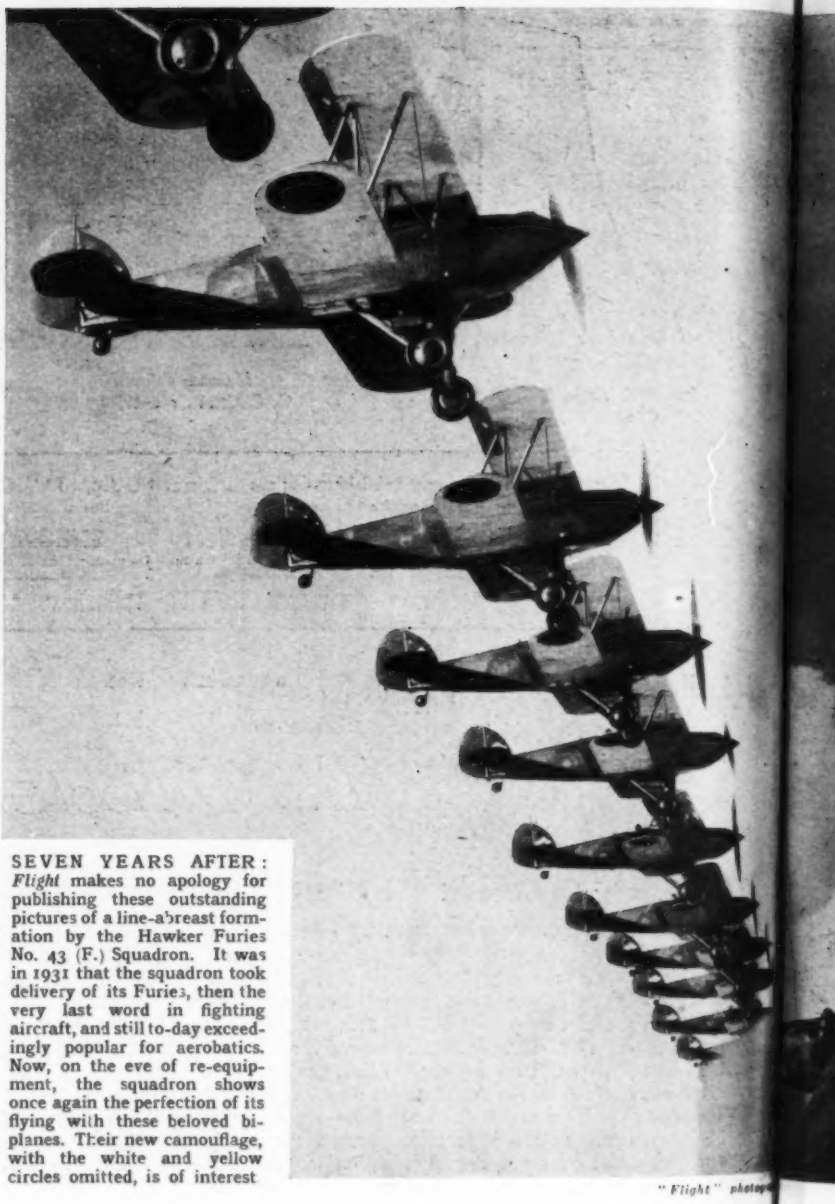
The conclusion to which all this leads is that boundary-layer control is the only avenue in sight at the moment, and the price which will have to be paid for the ability of being able to keep the boundary layer flow laminar instead of turbulent is still unknown. The power absorbed is likely to be considerable, according to all experiments made so far.

Another Aspect

ONE would not for one moment suggest that the distinguished German lecturer deliberately set out to spread gloom over the "Royal and Ancient" society, but by concentrating upon maximum speed he did select the one direction in which—as is known from fundamental principles—spectacular further progress is most unlikely to come except with great power expenditure. There is no need to deduce from this that the position is equally hopeless in all other directions. For instance, the very fact that a 30 per cent. reduction in minimum drag is considered theoretically possible should surely be of the very greatest practical use, even if it would only give us a ten per cent. increase in maximum speed.

Instead of trying to use this drag reduction for the least promising purpose, let us make use of it in directions in which it *will* do some real good. If the minimum drag can be reduced by 30 per cent., the horsepower required at existing speeds is correspondingly reduced. That fact can be used to increase the range or the payload or a combination of the two. With Atlantic air services occupying the foreground of the picture, as they will do during the next few years, there is ample inducement to use every endeavour to save drag so as to get it back in range and payload.

DIARY OF FORTHCOMING EVENTS—PAGE 472



SEVEN YEARS AFTER: *Flight* makes no apology for publishing these outstanding pictures of a line-abreast formation by the Hawker Furies No. 43 (F.) Squadron. It was in 1931 that the squadron took delivery of its Furies, then the very last word in fighting aircraft, and still to-day exceedingly popular for aerobatics. Now, on the eve of re-equipment, the squadron shows once again the perfection of its flying with these beloved biplanes. Their new camouflage, with the white and yellow circles omitted, is of interest

"*Flight*" photo

The really large aeroplane may, as Dr. Roxbee Cox pointed out during the discussion, make possible a reduction in the percentage of wetted surface formed by the non-lifting parts of the aircraft, and in that way further improvement may be possible. Professor Junkers' "Nurflügel" (all-wing) aircraft is still an ideal worth aiming at. It will only be possible in really large sizes (spans, and particularly chords far greater than any we have used hitherto), but the technical possibilities are there. What is chiefly wanted is conviction in the right quarters, and the courage of that conviction to sanction the spending of the necessary £ s. d.

Losing a Lead

IF Dr. Seewald's lecture painted the future somewhat black as regards the prospects of greatly increased aircraft performance, some of his records of achievement should give us in this country a very serious jolt, and were sufficient to produce signs of considerable

uneasiness in the audience. This was particularly the case when the lecturer described the work which has been done on high-altitude engines and supercharger development at the DVL.

"On the basis of these results," Dr. Seewald said, "it is possible to attain constant pressure up to 10 km. (33,000ft.) altitude with a single stage, and without having to arrange for the cooling of the compressed air before admission into the motor." The chief of the DVL said other things which might well shake what little pride we still have left in our own achievements, but that sentence deserves to be put up in every aero engine design office in this country, and in letters two feet high in certain sections of the Royal Aircraft Establishment at Farnborough.

It is only a few years ago that Great Britain was far ahead of Germany in the development of superchargers and supercharged aero engines. If we have let her overtake and pass us in that particular field there is something wrong somewhere, and we ought to feel thoroughly ashamed of ourselves. Granted that Dr. Seewald did not say that Germany *had* succeeded in maintaining ground-level pressure up to 33,000ft. with a single-stage blower and without coolers, but he would not have expressed himself as confidently as he did if he had not been certain, as a result of the work carried out, that this result is possible.

The moral is obvious, and the best thing we can do is to try to guess what will be the next great step, rather than waste our time in trying to catch up in this particular direction.

Blind-Approach Rationalisation

THE accident to the K.L.M. Douglas D.C.3 on Monday of last week brings the present difficulties of blind-approach technique into prominence. At the moment it is not certain whether the machine was actually being brought is on the Schipol ultra-shortwave beacon, but the available evidence at least goes to suggest that this was so.

Many years ago, when the Lorenz system was first shown to be practical for bad-visibility approach work, considerable hope was felt that the vertical indications would be of tremendous value. These indications have so far proved to be too unreliable for service and it is the custom nowadays to use the directional indications and marker beacon signals only; reduction of height is made with the help of a sensitive altimeter which has been previously corrected from information of the barometric pressure prevailing at ground level.

The sensitive altimeter is the key instrument both with the "ZZ" system and when approaching direct on a series of bearings so that, however the K.L.M. Douglas may have been making its approach, the circumstances are not greatly altered. With present methods the real danger is concerned with the fact that the pilot has too much to see and to do, and the business of making a blind approach is further complicated by the fact that, because altimeter indications cannot be trusted for the last few hundred feet, he must open his window and fly in over the last part of the distance by direct sight, with aural and instrumental assistance.

Whether or not last week's accident may be treated as an example, means should certainly be found to simplify this approach procedure either by more carefully planned drilling between the pilot and co-pilot, or, perhaps, by the development of a special combination instrument in which the time and height factors are clearly and unmistakably shown in direct relation to one another. The difficulty at present is that approaches are made neither entirely on instruments nor entirely by sight of outside objects. In particular, the moment of transition is a troublesome one.

THE ALBATROSS from the C

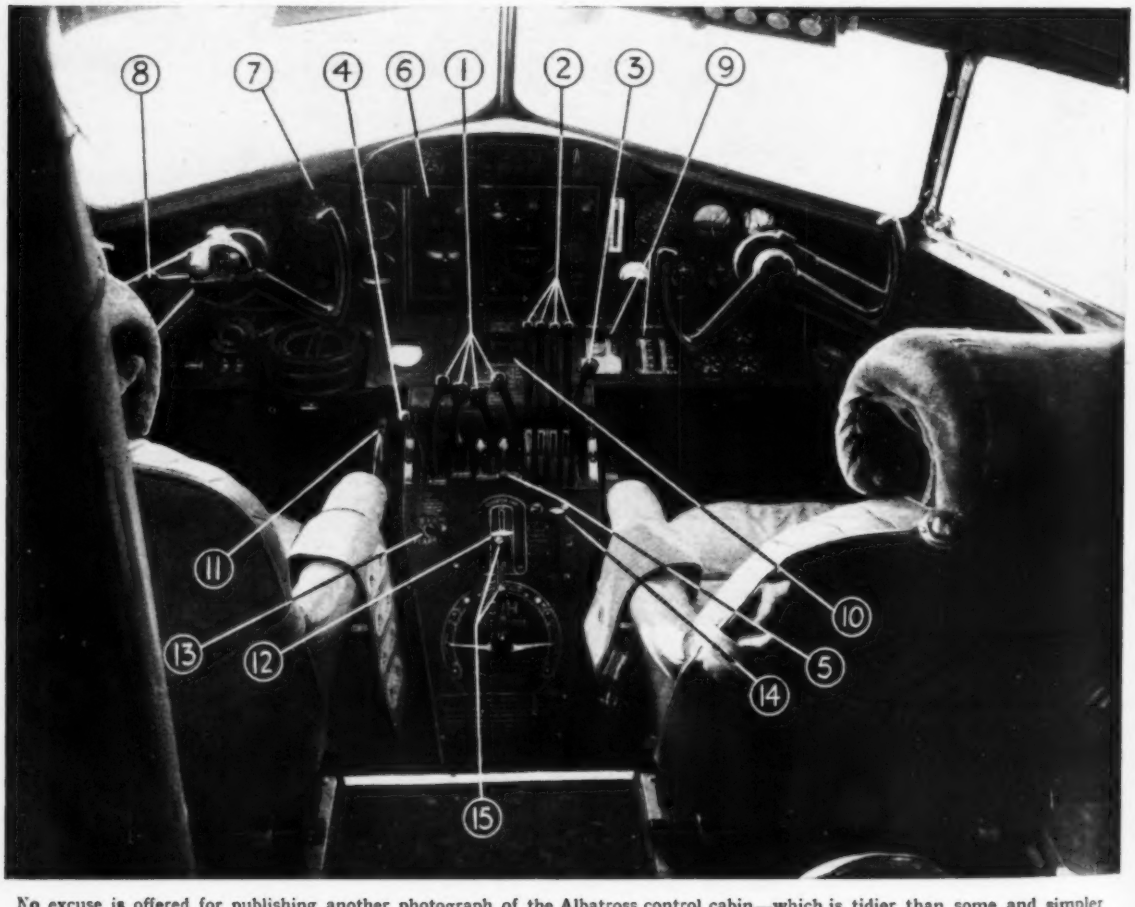
ONE of the extraordinary things about modern transport aeroplanes—in which the pilots, surrounded by a considerable array of control and instrumental devices, are sitting so far in front of the leading edge—is that it all seems to be very much simpler once one has an opportunity of riding in the control cabin of any particular machine. Even if one has little, if anything, to do with the actual conducting of the machine, one feels thoroughly safe and happy.

The effect is partly that of being provided with such an extremely good view of the world as a whole, and partly, perhaps, because no person of reasonable flying experience really likes sitting in a passenger compartment from which nothing of any real importance can be seen. In this compartment the impressions of the rightness and wrongness of any particular technique of take-off or approach depend entirely on a feeling of buoyancy or otherwise, and on the nearness and spikiness of things like factory chimneys as they hurry by.

Whatever its faults, the modern transport aeroplane is certainly easy to fly, and the addition of an automatic pilot takes away almost all that is left of solid work for the pilot, who can nowadays concentrate entirely on navigation, either while on his way, or while placing the machine correctly in relation to the airport boundary during a blind or semi-blind approach. And the D.H. Albatross, in which I had a chance of flying last week largely as an onlooker second pilot, is no exception.

The machine seems to be very stable in all axes yet is, at the same time, most remarkably manœuvrable for its size. Admittedly, this manœuvrability was being incidentally demonstrated by the test pilot who has done more flying with the type than any other—Mr. Geoffrey de Havilland—but at the time the cloud base was so very low that the execution of any sort of steep or climbing turn demanded a confidence in the machine which was proof in itself. When I took over for a short time I had a feeling that there was barely enough room between the cloud-base and the tree-tops for a machine of this size, and my own performance consisted entirely of fairly gentle turns and a little adjustment of trimming devices.

These (or, at least, the fore and aft trimming wheel, which is the only one of importance) are light and quick in operation. A movement of an inch or so on the wheel, which is on the first pilot's side of the throttle bank, is quite enough to make the difference between a gentle climb or level flight. When making steep turns with a really large machine one expects to find it necessary to use this trimming wheel quite a lot, but, in fact, no retrimming is necessary with the Albatross when it is being taken

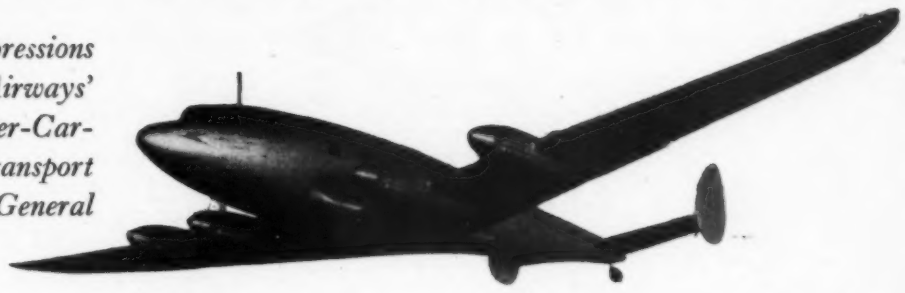


No excuse is offered for publishing another photograph of the Albatross control cabin—which is tidier than some and simpler than most. Below is a key to the more important controls and instruments.

1. Throttles.
2. C.S. airscrew controls.
3. Automatic pilot cut-out.
4. Landing light control.
5. Mixture and slow-running cut-out controls
6. Sperry pilot panel.
7. Instrument flying group.
8. Brake lever.
9. Revolution counters.
10. Undercarriage switch and indicator.
11. Fore and aft trimming wheel.
12. Fore and aft trimming indicator.
13. Flap operating switch.
14. Flap indicator.
15. Rudder and aileron trimming cranks.

CONTROL CABIN VIEWPOINT

Assorted Impressions of Imperial Airways' Latest Passenger-Carrier—and of Transport Technique in General



round quite tightly. Obviously, the elevator control is sufficiently light, yet there is not a trace of instability in the fore and aft plane.

This particular characteristic should be helpful when attempting to fly with great accuracy on instruments. One of the special difficulties of a blind approach either on a comparatively narrow ultra-short-wave beam or on a succession of QDMs is that the fore-and-aft attitude alters so considerably while making quick little turns to regain the constant note line. If the nose-dropping (and speed-gathering) tendency during a turn cannot be checked without recourse to the trimming wheel, the whole business is made considerably more difficult. Even when using the control column alone, it is hard enough to maintain a constant motoring approach speed of, say, 100 m.p.h. Hence the fact that the much-criticised fore-and-aft "unfeelingness" of the Link ground trainer makes this device even more valuable. If you can hold an accurate approach speed on the Link with the "bumps" turned on, you should be able to do so with a real aeroplane in black conditions.

However, this "flying" of mine showed that the Albatross flies happily on the ailerons alone—or, for that matter, on the rudder alone, though this is almost rigidly heavy. Anyway, except at very low speeds, the directional control surfaces are not needed, and with modern speeds it is hardly to be expected that a pair of five-foot rudders will be easy to move. And if attempts are made to lighten the control by means of servo tabs or other devices there is always the chance that the rudders will try to take charge during more violent corrections at low speeds. I believe that the Albatross in its earlier stages had such servo assistance, and that this was washed out as being both unnecessary and troublesome.

Viceless Take-off

Undoubtedly, the most interesting feature of the Albatross, in comparison with other transport machines, is the way in which it takes off more or less by itself; only incidental rudder corrections are necessary, and then only during the early part of the run. On this occasion Mr. de Havilland first held the machine on the brakes (by means of the convenient little lever in the centre of his control spectacle) while opening up the throttles about a third of their movement until all four engines were providing an even power output. Then the brakes were released and the four throttle levers were pushed firmly forward to the dashboard. No need to pull one or other of the outboard throttles back to hold a swing, and no need to open them up with uneasy action. This viceless feature should also be of considerable value when the Albatross, in service, is being taken off on instruments.

Once in the air the large switch to start the electric undercarriage motor was moved and the warning light beside it flickered from green to red while the r.p.m. indicators showed 2,600—at which speed four Gipsy Twelves were giving their maximum power of 525 b.h.p. When a reasonable amount of height had been obtained the throttles were brought back to their cruising position and the constant-speed airscrew levers adjusted to hold the revolutions at about 2,200, which is the cruising figure for the engines. At this they each give 300 h.p. at ground level—or 325 h.p. at optimum altitude, which is 11,000ft.

This particular flight was being made for a test of the Sperry automatic pilot, which was cut in to climb us up through the clouds into bright sunshine. Unfortunately, and although *Falcon*, the machine concerned, had full radio equipment installed, no operator was carried, and in any case it could not have been used to bring us back to Hatfield. So as soon as the machine had been levelled off above the clouds it was turned steeply through 180 degrees and brought down again through them to break the ice over St. Albans.

In the circumstances, with the clouds sitting on the Chilterns, it would obviously have been reckless to attempt to stay above them for any length of time. This fact prevented any reasonable estimation of the Albatross's cruising speed, since at ground level this is not very much more than 180 m.p.h. at cruising revolutions. Furthermore, the conditions of the flight were such that at no time was it necessary to raise the cooling flaps, the control lever for which is on the right-hand side of the second pilot. Incidentally, as in the case of the majority of modern transport aeroplanes, all the engine temperature gauges are mounted, with their appropriate switches, on a board above the windscreen. During the short period of level flight above the clouds, however, the A.S.I. needle crept up to about 180 m.p.h.—which, at a height of a little more than 3,000ft., would be about right when the figure is corrected for altitude error.

Using the Flaps

During the take-off the slotted flaps were moved to the 30-degree position by means of a little four-position switch, the size of which is somewhat out of proportion to its importance. The take-off position for the flaps is marked on the mechanical indicator beside the switch, but by simply moving it to the intermediate "off" position, the flaps can be left firmly at any required angle.

During the final part of the approach and in the landing, the effect of these flaps, at least in comparison with those of the more normal split flaps, seems to be quite marked. Though they increase the approach angle to quite a fair and useful degree, one does not obtain that somewhat frightening impression of an over-severe amount of drag, and the approach (at an air speed of about 80 m.p.h. on a little throttle) is comfortingly steep without being too steep.

Once again the effect of being perched up in the nose, even of a very big machine, is to make the process of approaching and landing appear to be very easy indeed. I know that when I flew my first twin I expected to have the greatest difficulty in judging the attitude of the machine, and in remembering exactly where the undercarriage was. In fact, it is a great deal easier to judge an approach and landing from an eyrie in the nose than from some queer abode near the tail fin with a range of view which can be measured in a few segregated degrees.

Our landing seemed to be a bit of a wheeler—but that is how all aeroplanes should logically be put down. The undercarriage is there for use. When every transport aeroplane is fitted with a tricycle the fact will be appreciated.

H. A. T.

THE ROYAL AERO CLUB

Official News and Notices for the Week Ended November 19

Low Flying

THE General Council of Associated Light Aeroplane Clubs has been asked whether it wishes to submit any evidence to the Gorell Committee, which has been specially set up to consider flying over populous and other districts. All clubs have been requested to forward their observations.

Gliding: National Records

New national records for single-seater gliders have been set up this year. They are now as follows: Distance, 209 miles on April 30, by P. A. Wills; height, 10,080ft. on June 5, by P. A. Wills; duration, 15 hr. 47 min. on August 18, by Sub.-Lt. A. N. Young, R.N.

In addition to the single-seater records, the following multi-seater glider national record was established, which at the time beat the existing international record:—

Duration: 22 hr. 13 min. 35 sec. on July 9-10, by Flt. Lt. W. B. Murray and J. S. Sproule.

F.A.I. Meeting

The annual meeting of the Council of the F.A.I. will take place in Paris between January 6 and 8.

New Aviation Maps

The Club has received a supply of maps published by the French Bureau of Propaganda "Air Office," Quimper, covering several regions of France. The scale is 1/800,000.

Invitation from France

The Aero Club de Fécamp has written to the R.Ae.C. drawing attention to their landing ground at Eletot, outside Fécamp. The Committee of the Aero Club de Fécamp extends cordial welcome to all visitors by air who wish to visit the Normandy Coast in the neighbourhood of St. Valery and Etretat.

King Peter II Models Cup

The Royal Aero Club has received on behalf of the Society of Model Aeronautical Engineers the cup and trophies presented by King Peter II of Yugoslavia, for an international model competition, held at Ljubljana, Yugoslavia, on July 20-25, 1938.

This is the first year in which King Peter's cup has been contested, and the British team sent out by the Society of Model Aeronautical Engineers were the winners. It is a challenge cup and the contests next year will be held in this country.

European Air News

Luxembourg.—A German Notice to Airmen draws attention to the fact that in addition to the hangar 12 m. high and the club house 7 m. high in the S.E. of the landing area, there are further obstructions in the S.W., viz., steeply rising slagheaps, houses and, behind these, the chimneys and furnaces of the smelting works. The N.E. side is taken up by a high slagheap and the N.W. side is wooded. There is an H.T. cable on the S.W. side close to the aerodrome. The Notice also recommends that owing to the short distance available for take-offs, only aeroplanes with a high rate of climb should use this aerodrome.

Malta.—Taquali aerodrome has been opened to civil air traffic. Customs are provided, but no night landing facilities are yet available. The telegraphic address of the controller of the airport is "Airport, Malta."

AVIATORS' CERTIFICATES

No.	Name.	School or Club.	Date.
16,517	Edwin Arthur Biggs	Bournemouth	10.11.38
16,518	Reginald Morris Goodall	Cinque Ports	11.11.38
16,519	Hans Karl Traub	Airwork School ...	9.11.38
16,520	Frederick Bingham...	Air Taxis School ...	7.11.38
16,521	Richard George Colbran	Malling	23.10.38
16,522	Oswald Kenneth Houlbrooke Jones	Civil Service F.A. ...	4.10.38
16,523	Peter Harrison	Bournemouth	11.11.38
16,524	Keith James Falconer	Redhill	3.11.38
16,525	Sir Hamilton Westrow Hulse, Bart.	Hampshire	1.10.38
16,526	Stanley Howard Fey	Southend	21.10.38
16,527	George William Holey	London Air Park ...	8.11.38
16,528	Roy Mary Sharpe	Cotswold	11.11.38
16,529	James Henry Miller	Newcastle-on-Tyne ...	12.11.38
16,530	Robert Henry Read	Luton	23.10.38
16,531	Reginald John Salmon	London	12.11.38
16,532	Benjamin Innes Shayer	London Air Park ...	14.10.38
16,533	William Selby Howgate	Bedford...	14.11.38
16,534	Philip de Lacy Markham	Portsmouth	5.11.38
16,535	Leslie Frederick Berry	Redhill	30.10.38
16,536	Thomas Edward George Hanson...	Leamington, Warwick & District ...	12.11.38
16,537	Eric Crossley	Witney & Oxford ...	8.11.38
16,538	Noel Andrew Cotton Croft... ...	Cambridge	11.11.38
16,539	William Singleton Henry	North of Ireland ...	11.11.38
16,540	Frank Foster	Eastbourne	5.11.38
16,541	Alastair Stewart Ramsay	Romford	15.11.38
16,542	Lyon Curtis Quick	Hampshire	10.11.38
16,543	Esmé Seaton Winton	Bournemouth	14.11.38
16,544	Peter Mattison Wood	Yorkshire	30.10.38
16,545	Victor Noel Buchan	Eastbourne	16.11.38
16,546	Reginald Frederick Stedman ...	Yorkshire	9.11.38
16,547	Andrew Gordon Cameron	London Air Park ...	16.11.38
16,548	Roland Harry Cowdry	... ...	14.11.38
16,549	Hubert Broughton Showell ...	Norfolk & Norwich ...	12.11.38
16,550	William Edward Wroughton ...	Barnstaple & N. Devon	12.11.38
16,551	Monica Lucy Ann Strickland ...	York & Leeming ...	13.11.38
16,552	Charles Eric Kilner...	Bournemouth	17.11.38
16,553	Charles Albert Venn	Cardiff	17.11.38
16,554	Thomas Alexander Butler	Portsmouth	16.11.38
16,555	Harold Clifford Don	Brooklands	2.11.38
16,556	Walter James Mills...	Portsmouth	18.11.38
16,557	Dolores Theresa Sorour	Witney & Oxford ...	16.11.38

Forthcoming Events

NOVEMBER

Thurs., 24th. R.Ae.S. Portsmouth Branch Lecture: "Wood from the Seed Upwards," by R. H. Bundy.

Fri., 25th. Reading Aero Club: Annual Dance (10 p.m.) and Flying Members' Dinner, Falcon Hotel, Reading.

Fri., 25th. Strathtay Aero Club: Annual Ball, Salutation Hotel, Perth.

Fri., 25th-Sun., Dec., 11th. Paris Aero Show, with Air Transport Congress.

Tues., 29th. Institute of Transport: Brancker Memorial Lecture: "Development of Air Mail," by D. O. Lumley, O.B.E.; 6.0 p.m., Institution of Electrical Engineers, Victoria Embankment, London, W.C.2.

DECEMBER.

Thurs., 1st. Herts and Essex Aero Club: Annual Dinner and Dance, Park Lane Hotel, London, W.1.

Thurs., 1st. R.Ae.S. Lecture*: "Flying Controls," by Prof. G. T. R. Hill, M.C., M.Sc., F.R.Ae.S.

Thurs., 1st. British Air Line Pilots Association: "At Home" and Dance, Dorchester Hotel, London, 9 p.m.

Fri., 2nd. Eastbourne Flying Club: Annual Dinner and Dance, Grand Hotel, Eastbourne.

Tues., 6th. R.Ae.S. Isle of Wight Branch Lecture: "Flight Testing," by Capt. Courtney.

Thurs., 8th. R.Ae.S. Students' Section: Joint Lecture with I.A.E. Students' Section: "Carburation and Induction in Aircraft Engines," by K. C. Hunt; 12, Hobart Place, London, S.W.1.

Thurs., 8th. R.Ae.S. Portsmouth Branch Lecture: "Retractable Undercarriages," by G. H. Dowty.

Tues., 13th. Colleges of Automobile and Aeronautical Engineering: Annual Dinner and Dance, Grosvenor House, London, 7 for 7.30 p.m.

Thurs., 15th. R.Ae.S. Yeovil Branch Lecture: "The Paris Aero Show," by W. E. W. Petter.

Thurs., 15th. R.Ae.S. Coventry Branch: "Aero Engine Carburation," by E. W. Knott, M.I.A.E., M.S.A.E.

Thurs., 15th. R.Ae.S. Lecture*: "Some Results from the Deutsche Forschungsanstalt für Segelflug Smoke Tunnel," by Herr A. Lippisch, A.F.R.Ae.S.

Fri., 16th. D.H. Aeronautical Technical School: Reunion Dinner, London Aeroplane Club, 8 p.m.

Tues., 20th. R.Ae.S. Isle of Wight Branch: Debate.

Tues., 20th. R.Ae.S. Students' Section Lecture†: "The Air Mail Scheme," by Gibson Pattison, F.S.S.

* All these lectures take place at 6.30 p.m., at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1.

COMMERCIAL AVIATION

RECOGNITION : The Duke of Kent presents the Guild reliability trophy to Mr. J. W. Duggan, the chief pilot of Wrightways, at the G.A.P.A.N. reception held at Londonderry House last Thursday. Beneath the cup will be seen the Johnston Memorial Trophy for navigation, which was presented at the same function to Capt. D. T. C. Bennett, of Imperial Airways.

THE WEEK AT CROYDON

"A. Viator" on Fogs, Dogs and Distinguished Travellers

MONDAY is always a day which demands an extra little ray of sunshine and on Monday of last week Croydon weather visibly brightened as Miss Gracie Fields set foot on the tarmac. She was accompanied by her manager and pianist on a journey by K.L.M. to Rotterdam to see the première of her new film there.

Tuesday, by contrast, was thick fog and nearly all inward aeroplanes cancelled or put down elsewhere—Southampton, for example, and Shoreham. I believe only one machine landed at Croydon all day—Imperial Airways' *Dardanus* from Brussels. That is perhaps worth recording for the benefit of people who fill the Sunday papers with stories that Imperial pilots cannot land in fog.

The International Air Traffic Association has just held its annual session in London, bringing chiefs of air transport companies from every city in Europe. Amongst other and perhaps graver issues, was one decision which allows dogs to travel by air either as passengers or freight, but not as luggage. In other words, unaccompanied dogs must be freight, and accompanied ones, if small, may travel with their owners in the cabin, provided they are landed in a basket and not loose.

I do not know if this applies to all sorts of dogs, as for example, gay dogs from Paris, hot dogs from U.S.A., and fire-dogs from, let us say, Tierra del Fuego; but the rule may possibly bring difficulties to the companies.

Before a dog can land in England it must have a Ministry of Agriculture licence and must be met by proper persons and conveyed swiftly to quarantine. Woe betide the dog that sets foot on English soil—or tarmac—if its papers are not in order and, worse, woe betide the wretched air company in these cases. It is not only the owner the authorities go for, but the carrying company.

To hear the magistrates on these occasions, you'd say bigamy, barratry and bumping-off-brides-in-the-bath are mere childish frolics compared with accidentally importing a small dog.

Major General Karl Bodenschatz, Senior Official of the German Air Ministry and regarded as Field Marshal Goering's right-hand man in air affairs, made an unexpected visit by air to London on Sunday, arriving at Croydon by special D.L.H. machine. He was met by German Embassy officials.

There was a nice little example of international co-operation last week when an air ambulance of North-Eastern Airways conveyed a passenger from Croydon to Newcastle after the patient had arrived by K.L.M. from Rotterdam. Rotterdam-London took a couple of hours and London-Newcastle via Doncaster took well under two and a half. The patient was transferred at Croydon without delay and arrived the other end none the worse for the flight.

The R.A.F. wiped everybody's eye the other day, when they made what newspapers call a new record from London to Paris, though I should say the Blue Riband of the Channel could only be held by a genuine commercial aeroplane flying for hire and reward. Anyway, Mr. G. K. Quill flew from Croydon to Paris in 50 min. when delivering a Spitfire for exhibition at the Paris Aero Show. Capt. J. T. Percy, of Imperial Airways, flew *Frobisher* from Brussels to Croydon in 67½ min., this being 20 min. better than Imperial's previous best for that run. What is more, he had a 30 m.p.h. head wind.

A. VIATOR.

THE CIVIL FAIREY

WHEN the new research department at the Fairey Aviation Company was officially opened a few weeks ago visitors were interested in the model of a four-engined civil landplane which was being used for demonstration in the wind tunnel. At the time it was known that the company had submitted a design to the Air Ministry, and it has now been announced that an order has been placed for the machine.

In a general way this new civil type resembles the American D.C.4 in that it is a four-engined, low-wing, all-metal stressed-skin monoplane with a retractable tricycle undercarriage, and pressure cabin for regular high-altitude operations. The provisional information suggests a normal range of about 1,500 miles and a cruising speed, at 10,000ft., of 220 m.p.h. The maximum speed will be in the vicinity of 275 m.p.h. There will be accommodation for thirty daytime passengers.

No decision has apparently been made about the engines which will eventually be fitted, but these will be of approximately 1,000 h.p. and will, of course, have constant-speed (and presumably full-feathering) airscrews. The specification generally has been based on the operational experience of British Airways, but from what one gathers the machine is more likely to be used on European services than on the South Atlantic crossing, for which Short boats will probably be ordered.

COMMERCIAL AVIATION (CONTINUED) : WORLD NEWS

A New Straight Venture

ON January 1 the Straight Corporation scheme for large-scale commercial flying training will be started. Capt. W. N. Cumming, D.F.C., late of Imperial Airways, who has been flying during the past two seasons on the New York-Bermuda service, will be in charge of the scheme, details of which will be announced in due course.

Pilots' Night Out

WITH the exception of the few unfortunates condemned to night runs, commercial pilots will probably gather in force at the Dorchester Hotel, London, on December 1 for the B.A.L.P.A. "at home."

Proceedings (ominously formal but obviously unfitting word) begin at 9 p.m., and there will be dancing from 9.30 until 2. Tickets are 12s. 6d. single or 22s. 6d. double, from the secretary, Mr. H. R. Latreille, 4, Fox Hall Gardens, London, S.E.19.

Air France to Egypt

AIR FRANCE will, it is now definitely stated, open up a new service to Egypt, thus entering into competition with services already operated by Great Britain, Holland and Italy. It would perhaps be more accurate to describe the French service as from Paris to Syria, with incidental stops at Tunis and Cairo.

The new route will be welcomed by the French community in Egypt, although it would have been even more welcome had the line been from Paris, via Marseilles and Athens, to Cairo, using fast medium-capacity machines. Actually, the new line to Cairo will, in all probability, be flown by Dewoitine 338s, which will be used right through the 9,000-mile journey from Paris to Hong Kong. At present these machines are used only between Damascus and Hong Kong.

A New Far East Route ?

AN interesting suggestion was made by Mr. Gunnar Larsen at a recent meeting of the Danish industrial association, Industriforeningen. During his address, which dealt with the future role of Scandinavian airline companies in international long-distance passenger transport, Mr. Larsen expressed the view that if Scandinavia were to have any hopes at all of being admitted into the business of intercontinental airline operation, attention should be concentrated on the possibility of opening and operating a route from Scandinavia, via Russia, to China and Japan.

From the financial point of view, Mr. Larsen thought that this could be done if the companies of Denmark, Norway, Sweden and Finland pooled their resources. The technical advantage of such a big air route is that it would be the fastest connection to the Far East, and when normal conditions were established in China and Japan this service would be remunerative even if it was restricted to the carriage of mail only.

The G.A.P.A.N. Reception

THE Permanent Grand Master of the Guild of Air Pilots and Navigators, H.R.H. the Duke of Kent, presented the awards at the Guild's reception, which was held at Londonderry House on Thursday evening of last week.

Two of these awards were presented to the pilots concerned, and the third, the Guild Navigator's Scholarship, offered by the Air League, was taken over by Mr. Wingfield, the Clerk, in the absence of the recipient, Mr. A. M. D. Howes, who was in East Africa, where he is employed by the Land and Mines Department at Dar-es-Salaam. This Scholarship is awarded to the candidate who obtains the highest number of marks during the year in all subjects in the Second Class Navigators' examination.

Mr. D. T. C. Bennett personally accepted the Johnston Memorial Trophy, given for his navigational work on the flight from Foynes to Montreal and his return journey via the Azores in *Mercury*. Mr. Bennett, in a few words of thanks, expressed his appreciation of the one-man work of his co-pilot, radio operator and navigator on this trip.

The four pilots of Wrightways—Messrs. J. W. Duggan, F. Brent, G. G. Stead and P. C. Fair—received (through Mr. Duggan, the chief pilot) the Guild Trophy for reliability, which was given by Miss Cumberbatch, and Mr. W. G. Speat, the managing director, replied for them. Needless to say, he gave due praise to his team of pilots, who had flown regularly every morning to Paris with the newspapers in all kinds of weather.

Another Condor for D.D.L.

ON November 15 Det Danske Luftfartselskab took delivery of their second Focke-Wulf Condor. It has been named *Jutlandia*, and is a replica of the company's first Condor, *Dania*, which was acquired last July.

The latter is at present in service on the Copenhagen-Hamburg-Amsterdam route, and during the winter season both will go on to this service. At the beginning of March next year, however, they will be put on to the new Oslo-Gothenburg-Copenhagen-Hamburg-London service, which will be one of the longest routes in Europe. This, it is expected, will eventually be run in pool by D.D.L. and D.N.L., the Norwegian operating company. Presumably, Oslo's new civil airport will be ready by that time, though there is a military aerodrome there which has so far been used by those civil landplanes touching at Oslo. D.N.L.'s fleet has previously consisted exclusively of seaplanes.

Guernsey's New Airport

WORK on the new Guernsey aerodrome is going ahead rapidly. A recent visit suggested that by the new year the main aerodrome buildings, apart from the hangars, should be finished, and only three more months will probably then be required for detail work. It is hoped that the hangars will be ready for use before March. Some ninety-seven acres of the landing area have been seeded and grassed.

The aerodrome, it is hoped, will be opened next May by the Bailiff of Guernsey. By that time short-range medium-wave, as well as short-wave D/F, radio equipment will be installed for the Channel Islands services—the limited range of the former being necessary because Jersey airport itself is the radio centre for the district.

When completed the area used will be rather greater than that at Jersey, and the maximum runs will be 1,000yd. in the E.-W. direction, 720 yd. in the N.W.-S.E. direction, 740yd. in the S.W.-N.E. direction, and 650yd. from north to south.

The Australian Mail Contracts

NEXT February will mark the end of existing arrangements for the distribution in Australia of overseas air mail after it has been landed in Darwin, and the Federal Government is now considering whether it will invite tenders or make a new arrangement by negotiation. At the moment, the distribution is carried out under six months' contracts by Australian National Airways, Guinea Airways, the MacRobertson-Miller Aviation Co., and Qantas, and the contracts which they at present hold (providing for the payment of subsidies) began in August.

The present arrangement is regarded as unsatisfactory by the airlines. They are reluctant to adopt a long-range policy when uncertain whether their contracts will be renewed. It is hoped that the Federal Government will rectify the position by increasing the contract period from six months to two, three, or possibly four years.

It is pointed out that these companies have spent in the past large sums on organising their airmail routes, but that they are now hesitant to commit themselves to additional expenditure until contracts are granted for a longer period. Guinea Airways, for instance, have spent much money on organising their route between Darwin and Adelaide, and the MacRobertson-Miller Aviation Co. has ordered two Lockheeds for its Darwin-Perth route.

Jan Duimelaar

K.L.M. has suffered a severe loss in the death of one of the company's eldest and best pilots, Commander J. E. Duimelaar, who was killed in a flying accident near Schiphol Airport on November 14.

He joined K.L.M. in 1922, and flew day in and day out on the company's European and Eastern routes. So far back as July, 1937, he had 12,119 flying hours to his credit, and had made twenty-two return flights between Amsterdam and Batavia.

Jan Duimelaar was a typical Netherlands merchant skipper of the air, sturdy, reliable, experienced, and with that peculiar quality of the born commercial pilot, an equal share of brilliance and caution.

At his funeral last Friday were men who had grown grey in the company's service standing at the graveside, and senior pilots, unaccustomed to showing their feelings, broke down and wept like children as they said their last farewell.

He was a man indeed, a man amongst men, who inspired these spontaneous signs of affection and grief. May he rest in peace.

Commercial Aviation

THE NEWEST FORMULA

De Havilland's All-metal D.H. 95 Nearly Ready : Interesting Production Methods : Verifying Stress Calculations

THERE is little new in the statement that, until comparatively recently, the official attitude towards airline operation has hardly encouraged manufacturers to lay out large sums of money in the quantity manufacture of high-speed machines. Nevertheless, it behoves us to bear this fact in mind when dealing with our first all-metal commercial machine. The De Havilland Aircraft Company has not suddenly decided that metal, after all, had certain advantages, but has simply been encouraged to go ahead because of the changing ideas about rates of subsidy and because of the consequently increasing amount of transport flying within the British Empire.

Years ago any other maker was equally at liberty to spend the amount of money that is necessary in jigging up for quantity metal manufacture, if there had been a reasonable chance that this cash would have been returned in due course. Certainly, with an adequate promise of support from our own airline operators, dozens of suitable machines could have been sold both to the colonies and to countries abroad, but the fact remains that, apart from Imperial Airways who have always demanded a somewhat specialised type which would have no sale elsewhere, the support was not forthcoming.

The D.H.95 is now nearing completion at Hatfield and plans have been evolved for the quantity production of this machine. In order to simplify manufacture the machine has been designed throughout so that as much detail work as possible is carried out on components before they are finally assembled. The jigs are broken down into comparatively small units, both with the object of economising floor space and to permit ease and speed in working. The fuselage, for instance, is in two parts, the nose, carrying the control layout, being a separate and detachable unit. Thus the work in the installation of such items as the control system, the instruments and the automatic pilot can proceed without interrupting that on the machine as a whole. Furthermore, this detachable nose can easily be replaced if it is damaged. Again, the two halves of the tailplane are symmetrical and interchangeable, while the outer wing extensions are detachable

It will be remembered that the D.H.95, or Flamingo, is a high-wing machine with two Bristol Perseus XIIc sleeve-valve engines of 850 h.p. each. The installation of these engines has been designed for quick unit replacement, and an interesting point is that the accessory drive gear box for each engine is mounted not on the power unit itself, but on the wing spar. This box is coupled by a flexible drive which can, of course, be quickly detached and there is therefore, no necessity, when an engine is being changed, to uncouple the various connections between the gear box and the units which it drives. All the electrical connections, too, are made with multi-pin plugs.

During last week the undercarriage was being installed, after a unit had made 150 raising and lowering operations in order to test the hydraulic actuating gear. A special test rig was arranged for this purpose on the mock-up, and here again the separation of work should have saved a good deal of time in the manufacture of the prototype. An undercarriage compression leg, with the fork, wheel and tyres was also given ten hours' continuous load-testing, during which some 30,000 full-load blows were given to the unit. Incidentally, there should be no likelihood of undercarriage trouble in the 95 since the retraction gear has three available sources of power. Normally it is hydraulically operated by means of an engine-driven pump, but there is also a stand-by hand pump as well as an emergency system complete with air bottle and entirely independent pipe-line system.

Apart from the undercarriage tests already mentioned various portions of the Flamingo have been subjected both to proof-loading and destruction tests so that further alterations will be unnecessary after the prototype has been completed. The sections of the structure actually tested to destruction were the tail portion of the fuselage; the section of the fuselage which includes the door opening; a complete aileron and a complete tailplane; the centre-section and undercarriage structure; and a portion of the main spar, including the joint between the centre-section and the outer wings.

After assembly the entire wing structure was tested to prove that there was no possibility of aerodynamic flutter, and the stiffness actually proved to be nearly 40 per cent. greater than that recommended by the Air Ministry. Further proof-loading tests (which involve applying five-eighths of the loading at which the structure is calculated to fail) were applied to completed fuselage and centre-section with the undercarriage and tail wheel.

Wing Structure

The 95 is entirely metal-covered with the exception of the trailing edge of the wing and the control surfaces. All the torsion and drag stresses in the outer wing sections are taken by the leading edge portion of the wing, the trailing edge simply taking the additional lift stresses. It will be remembered that the centre-section is a three-spar structure, while the outer sections have only the one girder-type spar—reinforced, of course, by the D-box leading edge structure.

At the moment the work of installing the control leads and instruments is going ahead, but already one or two interesting features can be seen. For instance, the horizontal section of the control column, which protrudes through the dash, can be instantly adjusted for reach. Incidentally, the view provided for the crew should be extremely good, with deep windows arranged at just the right height. The top of the nose section is hinged so that the control and the wiring arrangements can be seen. The rest of the nose section is used as a freight and mail hold for which there are two entry doors.

The various loading schemes were described in *Flight* of November 10. There are three different layouts, one for twelve passengers, in which form the machine will be normally used for medium-distance operations, another for seventeen passengers, and the third for twenty passengers. In the last form the machine will be suitable for short-haul work.

Speed-up in New Zealand

LAST month Union Airways of New Zealand started a new mail and passenger service between Wellington and Dunedin via Christchurch. This has replaced the previous service between Palmerston North and Dunedin via Blenheim and Christchurch, and is very much faster. The usual morning machine will leave Auckland for Wellington and will fly through to Dunedin in the south. Another machine leaves Dunedin at approximately the same time in the morning to fly over the route in the reverse direction.

This service is operated with Lockheed Electras, and the D.H.86s, which were previously used on the Palmerston North-Dunedin service, do not go beyond Christchurch. The 86s, in fact, will be used for the feeder sections. Union Airways' 86s have been operated very successfully and without suffering any serious mishap during the last three years. In due course, it is rumoured, these machines will be replaced by D.H.95s (some new information about which appears above), and the first of these should be flying at Hatfield early next year. Incidentally, the only subsidy received by Union Airways is that from the Post Office of 1d. per letter carried.

The Amsterdam Accident

ON November 14 a K.L.M. Douglas D.C.3 struck the ground while making an approach into Schiphol Airport, Amsterdam. Six persons were killed, including Captain J. J. E. Duimelaar and the three other members of the crew, and two of the fourteen passengers; many others were seriously injured. The machine was flying on the Berlin-Amsterdam service.

Until more evidence is available it is not possible to be certain of the causes of the accident, but at least it appears that the pilot was coming in either on a succession of QDMs or on the ultra-short-wave beacon. The weather was bad, with a low cloud ceiling and drizzle. It is always possible that the pilot had been given an incorrect barometric pressure, had made an error in the necessary adjustment of the sensitive altimeter, or was watching for a first view of the ground while the machine accidently lost the little remaining height. Certainly the Douglas appears to have been in the usual motoring approach attitude, since otherwise the result of the accident would have been far more serious. The machine travelled several hundred yards before coming to rest.

TRANS-CANADA

Last month the Trans-Canada Air Lines' service was officially extended to cover the section between Montreal and Winnipeg. In this set of pictures there are three views of one of the ten Lockheed Fourteens which are now, with five Electras, in service, and two pictures of typical Canadian terrain. Above, are the San Juan Islands near Vancouver, while on the right is a Fourteen taking on mails at the Winnipeg terminal.

THE FOURTEENTH YEAR

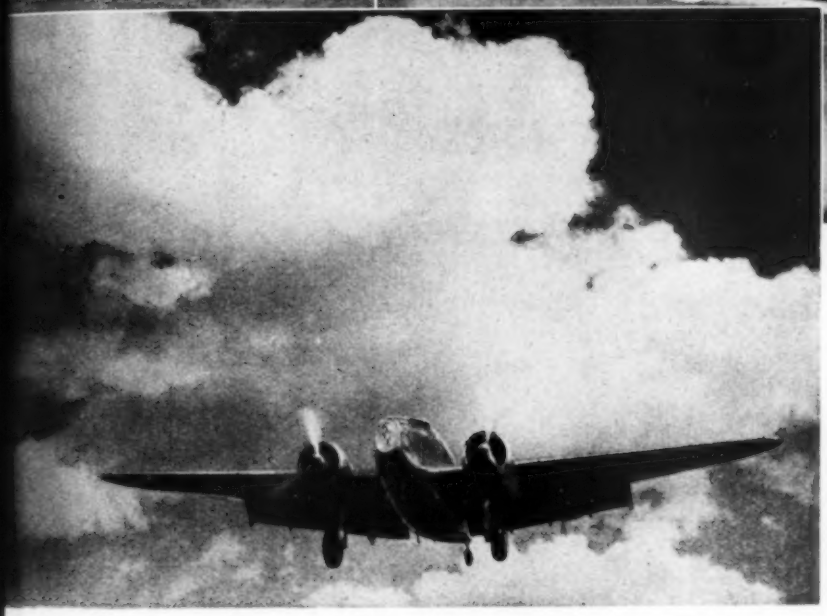
Points from Sir John Reith's Speech at the Annual General Meeting of Imperial Airways

SINCE the Government statement concerning the association of Imperial Airways and British Airways into a single public corporation had only been made a few days previously, it was not to be expected that anything of importance about future policy would be revealed at Imperial Airways' meeting on Tuesday of last week. Sir John Reith, in fact, merely gave a résumé of the company's work during the preceding year, and his remarks about its future were those actually designed before the Air Ministry announcement.

The Chairman first of all surveyed briefly the history of the Empire air mail scheme, the first stage of which began on June 29, 1937, and the last (apart from the termination of the European agreement on March 31 next year) on July 28, 1938. After commenting on the more important items in the financial report he explained that the reduction in gross profit did not represent a fall in the gross revenue which, for the year, and taking the subsidy into account, amounted to the sum of £1,980,000 as compared with £1,729,000 for the previous year. Expenditure on a ton-mileage basis, before charging obsolescence, was 3s. 10d. against 4s. 8d. Route-mileage had increased from 20,329 to 22,395—a matter of 10 per cent.

At the previous meeting the Chairman had explained that the items of the new fleet, ordered in 1934 for the European services, were then a year overdue; only now had the first one been delivered. The European services had, therefore, been operated under a severe handicap and could not be expected, in the circumstances, to have carried the same number of passengers as in the previous year, particularly while working in competition with faster foreign services and with those of British companies using foreign machines.

Dealing with the Empire services, Sir John Reith said that the West African branch had been extended from Lagos to Accra in October, 1937, by an associated company, Elders Colonial Airways. Traffic on this particular service had been hampered by health restrictions, but the company had now produced an apparatus which exterminated mosquitoes in aircraft. Late deliveries of the new fleet had also caused the all-up air mail scheme for the India and Malaya section of the Empire services to be delayed. These services were run partly by flying-boats and partly by the present fleet of landplanes. On the Hong Kong route an alteration had been made by which the machine flew now from Bangkok, via Udorn, Hanoi and Fort Bayard to Hong Kong. On the New York-Bermuda service the considerable reduction in the level of passenger fares on American domestic lines had caused Pan-American Airways to follow suit on the Bermuda service, and Imperial Airways had necessarily to do the same. The revenue of this service, therefore, failed to reach expectations. Only one transatlantic experimental flight had been made, but the



On the left, one of the T.C.A.L. Fourteens is shown coming in to land with the large-area Fowler flaps in the down position. Above is a view of the Coast Range, near Seattle, while in the centre, above, is another scene at Winnipeg, with a Fourteen being refuelled. The transparent nose, enclosing the D/F loop, is an interesting feature. Without such an arrangement it would be necessary for this loop to be outside the fuselage, which is otherwise metal-covered.

company had co-operated in the application of a refuelling scheme for flying-boats. The experimental work, which was promising, permitted long flights to be made while carrying much greater loads.

Referring again to the delays caused by fleet shortage, Sir John suggested that the difficulties of obtaining delivery in accordance with the contract might force the Board to apply for permission to adopt some variation of the policy by which only British aircraft and engines were bought.

The company had suffered considerable inconvenience through the lack of a combined marine and land airport at Langstone Airport, Portsmouth, though it was not their responsibility to provide this base. In the meantime the boats were operating from Southampton, where the limited accommodation and maintenance facilities constituted a considerable handicap and inconvenience, notwithstanding the full co-operation of the Southampton Harbour Board and the Southern Railway. The new London terminus and head office should be in use next March, and this would provide much-needed additional accommodation.

Directorial Changes

The Chairman then referred to the report of the Cadman Committee and explained how, as Sir George Beharrell had been unable to give up his responsibilities elsewhere, the directors had invited Sir John Reith to become chairman following the recommendation that the company should have a full-time chairman and one or more full-time directors. Sir James Price, who had had great experience of staff and labour problems generally, had also joined the board, while at the end of June Mr. Woods Humphrey's long managerial control of the company ceased with his resignation. It was easy to see points for criticism after the event, and the company, through its directors, managers and staff all over the world—but pre-eminently owing to Mr. Woods Humphrey—had done magnificent work in the face of difficulties and it deserved well of the community. Its achievements had not received the recommendation they merited, while its faults were magnified as faults usually were, until there seemed little else to tell. Imperial Airways was not a compact organisation easy to control. The staff had increased from 1,200 in 1933 to more than 3,600 at present. It operated in thirty countries and, growing quickly as it did, it was not surprising that there were a few loose ends in the organisation as a whole.

The Cadman Committee had also advised that the dividends of subsidised air transport companies should be limited as in the case of many public utility concerns. This, put into effect by itself, would be unfair to shareholders who had accepted the risks of pioneering new means of transport and had received, on the average, only a modest return during the past fourteen years. The ideal of self-sufficiency was incompatible with that of ensuring that the airways of this country would lead the world. The position of Imperial Airways before the Government statement was neither commercially nor constitutionally satisfactory.

Referring briefly to the announcement of the merger (the details of which were given in last week's issue) Sir John said that the need for large additional capital for development purposes had held the board's attention for some time and any alteration to the Government's plan would entail either a great increase in ordinary share capital, or the creation of shares with rights ranking in front of the existing shares. Whatever its legal powers under the articles of association, the board would not agree to any price for the sale of the undertaking without calling another meeting of shareholders.

In reply to questions, Sir John said that the new scheme did not constitute their being taken over by the Government. What would happen was that a public corporation would be formed, similar to others in existence, and this would take over the two companies.

COMMERCIAL AVIATION (CONTINUED) : WORLD NEWS

The "Clearance" Altimeter

IN a recent issue we gave some information about a new radio altimeter, if such it can be called, which indicates the actual height of a machine above the ground. Some further information has now appeared, and in this the method of measuring the "time" between the transmission of the radio signal and the reception of the reflected signal is explained. Obviously, when dealing with radio waves, which travel at a speed of 186,300 miles a second, it is impossible to deal in terms of time-lag as such.

The transmitter in this case uses a continuously varying wavelength, the frequency changing from an undisclosed minimum to a maximum of 500 m/cs.—the highest ever used commercially. The change is made at the rate of 80 times a second by means of a motor-driven variable condenser, which is arranged so that the frequency variation is, so to speak, linear—*i.e.*, it may be represented in graph form by a straight-line saw-tooth pattern.

Both the transmitted and the received waves, of course, have an identical pattern, but the two are shifted in relation to one another because of the longer distance travelled by the reflected wave. The amount of this shift can apparently be used to measure the distance between the transmitter and the point of reflection.

Pan-American Pyrotechnics

THE difficulty of arranging a suitable night-landing system for flying-boats is a very considerable one, and in the issues of July 7, 1938, and September 29, 1938, we described briefly how Imperial Airways had solved the problem.

Curiously enough—and suggesting that this flare-buoy system must be the only one which is at present suitable for the work—Pan-American Airways have devised a somewhat similar system. Experiments were started by this company in 1932, and the various ideas were tried out during a number of years of operations in the Caribbean, along the east coast of South America and in the Pacific. The eventual equipment was actually developed by Lights, Inc.

The basic item of the equipment is a 26ft. launch which is located at each flying-boat base. Besides its normal power unit this launch also carries a petrol-driven generator to supply power for searchlights and a radio telephone set.

The next part of the equipment is a twin-hull float with a small platform carrying a storage battery and two upright members, one 3in. and the other 10in. high. On the lower member a bright red or green light, similar to obstruction or boundary lights used on land, is mounted, while on the higher upright is a similar white light.

The third item is a small wooden box made largely of balsa and carrying a storage battery and a boundary lamp which can be white, green or red, and designed either to burn steadily or to flash periodically. This box is anchored to the sea bottom.

When a machine is expected after dark the launch tows three light-floats out from the station, the crew selects the runway according to the wind direction and the searchlight operator examines it for possible obstructions. Sailing into wind down the runway, one of the green flashing-box buoys is first cast loose and anchored; farther on a light-float (with its lower light green) is cast loose and then at 100-yard intervals three more of the box buoys (one green flashing, one green steady and one white flashing) are also put overboard. Finally, after another hundred yards, a further light-float is put down. The whole process is then repeated with a different colour sequence and at the end a third light-float is placed with a red lower light.

The whole makes a 2,700ft. string of lights pointing exactly up-wind with an easily-judged system of distance markers along it. After laying these lights the launch swings in a half-circle to the right and a row of box-buoys are laid out parallel to the first row, but 900ft. from it. Afterwards the launch takes up a position at the foot of the first row of lights with its searchlight shining diagonally up the runway.

So much for the landing. For a take-off two launches are used and another 1,600ft. of light-line is added. The first launch takes up its normal position, while the other remains at the far end of the short line and, at a signal from the machine, sends up a barrage of magnesium flares which give daylight conditions until the machine is in the air.

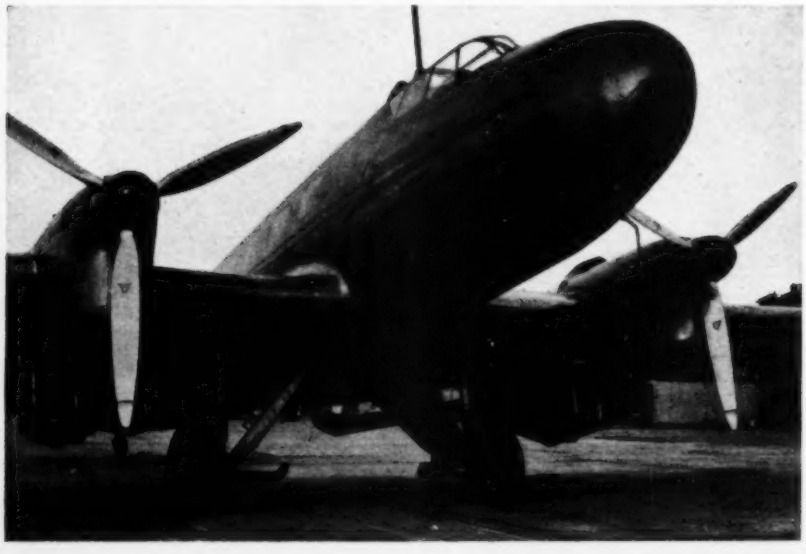
Next Year

A STUDY of the notices which have been recently published by the new Air Transport Licensing Authority gives some indication of the internal extensions which may be expected. Naturally enough, not all projects are yet sufficiently advanced for the companies concerned to ask for licences.

By next year, for instance, the landing ground at Stornoway should be ready and Western Isles Airways will be operating to this point from Glasgow, via North Uist. Scottish Airways, the parent company, may also be running a service from Aberdeen to Stornoway via Inverness.

The newly named Western Airways may be running from Bristol to Cardiff, Swansea and Barnstaple, while Channel Air Ferries, in their new link-up with Railway Air Services, will be taking over the latter's South and West of England runs. They expect to operate between Bristol, Cardiff and Swansea, between Bournemouth, Bristol, Cardiff and Swansea, and between Swansea, Barnstable, Newquay and Land's End. Western Airways is, of course, the name by which the Bristol Channel ferry concern has been known since last month; it is now under the control of the Straight Corporation.

For many years Air Dispatch have had the idea of (and have even operated intermittently) a service linking up London's aerodromes. They have asked for a licence to run a service between Croydon and Hatfield and calling at Redhill, Gatwick, Gravesend, Ilford, Hanworth, Brooklands and Heston. This service they hope to operate twice daily in each direction. At present they run what amounts to an on-demand service between Croydon, Heston and Hatfield.



WORKS FERRY : This diesel-engined Ju.86 seen at Croydon recently is the property of Junkers Flugzeugwerke and is used for customary business travels by the staff—and, in particular, by the managing director.

The G-Class Boats

IN *Flight* of November 3 we gave some details of the new series of strengthened Empire boats. These were alluded to as the "G-class." Although we ourselves had some doubt about this designation, the letter "G" was used firmly and clearly by Imperial Airways in their references to these machines.

Actually the series are still in the C-class and are generally referred to as the "modified C" boats. The G-class boats are the three very much larger machines which are now under construction. They will be named *Grenadier*, *Golden Hind* and *Grenville*. Their all-up weight will be thirty-two tons and they will be equipped with four Bristol Hercules sleeve-valve engines; a rated maximum of about 1,400 h.p. means 5,600 h.p. in all.

CARRIER at EXERCISE

A Week in H.M.S. Courageous : Bombing and Torpedo Exercises by Night and Day : Routine Duties : A Tour of the Ship

By CAPTAIN NORMAN MACMILLAN

(Illustrated with photographs by the Author.)

A POWER boat pulled alongside the centre pier at Invergordon. The cap ribbons of her crew read *H.M.S. Courageous*. I stepped aboard; a minute later we were foaming out to the aircraft carrier, a unit of the Home Fleet engaged in the autumn exercises.

It was a Saturday morning, and the whole Fleet lay in the land-locked bay. The ships made an impressive line—the *Nelson, Courageous, Revenge, Royal Sovereign*, four cruisers of the new Southampton class, and the usual host of smaller ships.

Saturday was a slack day, but it gave me the opportunity to meet some old acquaintances in the wardroom—among them fellows I had met as far apart as Felixstowe and Buenos Aires. Needless to say, filling in the years since we had met provided interesting conversation.

The best tale I heard concerned Sir Roger Keyes. That gallant Admiral of the Fleet is now a redoubtable supporter of the Naval Air Arm in the House of Commons. Before he retired he was not less keen and flew frequently. On three occasions he was "spilled into the drink."

The Admiral's Adventures

Once his pilot forgot to raise the land undercarriage of an amphibian after leaving a shore aerodrome; when the wheels touched the water she turned upside down and threw the Admiral out into the sea alongside his own ship.

On another occasion Sir Roger wanted to fly from a carrier at half-past ten. To be certain that everything would be ready, the Wing Commander ordered the ship-plane up for ten o'clock. The Squadron Leader made it half-past nine. The Flight Commander made it nine o'clock. The Flight Sergeant got the machine up at half-past eight, and the engine was started.

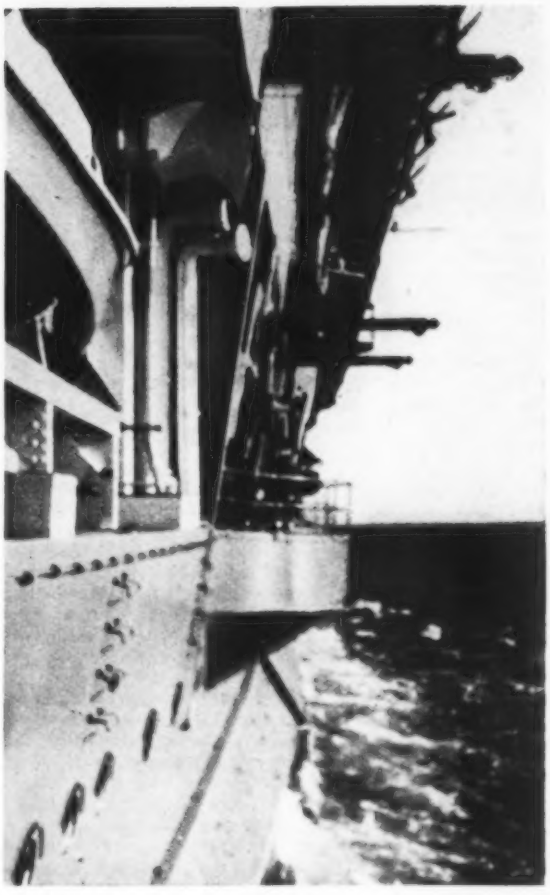
At ten-thirty the Admiral got into the cockpit and the pilot opened up. Just as he got off the deck the engine died. The plugs had oiled up after two hours' running. The Admiral alighted in the sea.

On the Saturday night there was a film show at the after-end of the lower hangar of the *Courageous*. Two films were of undistinguished Hollywood pattern. But one was a home-made drama, shot while the ship was at Malta during the Mediterranean crisis. The parts were taken by officers and men of the ship, and the plot concerned the well-frustrated efforts of a cunning spy. Although the film was sometimes dim because of insufficient lighting during the original exposure, the big boys of Hollywood would have been astonished at the reception it got, and I believe that, with sound added, the film would make one of the best short comics ever seen in a British cinema if it were issued for general release.

After a week at sea Sunday was a day of comparative rest, but in the morning the complement of the ship paraded on the flying-deck for Divisions.

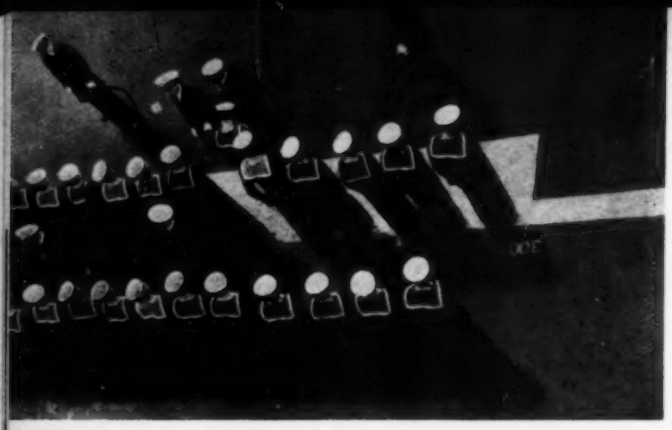
Here it may be as well to mention that *H.M.S. Courageous* is the flagship of the aircraft carriers. She carries the flag of Rear-Admiral C. C. Royle, C.B., C.M.G., the present Rear-Admiral, Aircraft. His Flag Captain is Captain C. A. A. Larcom. Under the delightful personality of its two senior officers, the *Courageous* impressed me as being a thoroughly happy ship and an exceedingly efficient one.

Divisions in the aircraft carrier was an interesting ceremony. There were about 1,300 men in the ship and, roughly, 1,000 were on parade. They formed up in double lines fore and aft facing inboard, with officers in command



Looking up towards the flying deck of *H.M.S. Courageous*—seventy feet above the water.

Divisions—the Admiral takes the salute.



(Left) Inspection before Divisions, seen from an unconventional angle.

(Right) Physical training on the flying deck.

of each section. In the centre of the flying-deck, just forward of the after aircraft lift was the Marine band, and in front of the band and, like it, facing the lift, was the guard of the Royal Marines.

The after lift rose, bringing the Admiral, Captain and their attendant staff officers to the flying-deck. Simultaneously the parade came to attention, the band played and the guard presented arms. The Admiral took the salute.

After inspection the guard marched to the extreme after end of the flying-deck, and there it remained throughout the parade, facing forward with fixed bayonets and rifles at the slope.

Came the order to parade in single file for inspection; to the music of the band each officer and man marched individually past the Admiral, formed into column again, and then wheeled into position to build up a solid square; when the last man had taken up position the parade was dismissed.

Divisions took about half an hour. With its background of grey water and, beyond, the low green hills that rose above the village of Cromarty, it was one of the most picturesque ceremonies I have ever seen

Off to Sea

By six o'clock next morning the ship was under way and steaming out through the narrow entrance to the Cromarty Firth. Clear of the land, she turned into wind to allow two Swordfish T.S.R.s to leave her deck; they were bound for the Orkneys to inspect the aerodrome at Kirkwall.

In the lay mind the thought of Fleet manœuvres no doubt produces a delightful picture of warships rushing over the ocean in mimic battle. Actually, Fleet manœuvres, or exercises as they are more properly termed, usually present a less dashing spectacle. As their purpose is mainly the training of personnel, the big ships, like the *Nelson*, can conduct many of their exercises while in harbour, and only put to sea for two or perhaps three days a week.

But an aircraft carrier, like the brood she carries, can operate only when under way. Therefore, during exercises she goes to sea every day of the week, and sometimes during the night also. Thus at such times there are days when the aircraft carrier operates as an isolated unit, far from other ships of the Fleet except her own escort destroyer. She takes a solitary part in torpedo attacks—technically called runner attacks—against herself, aerial bombing practice upon a towed target, deck-flying practice for special types of aircraft and new pilots, gunnery practice for the ship's gun crews, and, possibly, attacks made against her by aircraft based on shore.

All of these I witnessed.

For greater ease of operation and a wider range of training, two of the ship's four squadrons were ashore at Evanton. They carried out reconnaissance flights, bombing practice against the fixed target of the Evanton bombing range, gunnery practice in the air against a towed sleeve, fleet spotting exercises from the shore, and runner attacks against ships by day and night.

The two embarked squadrons were employed in purely ship exercises. They practised three methods of bombing, two variations of high-level precision bombing and dive bombing.

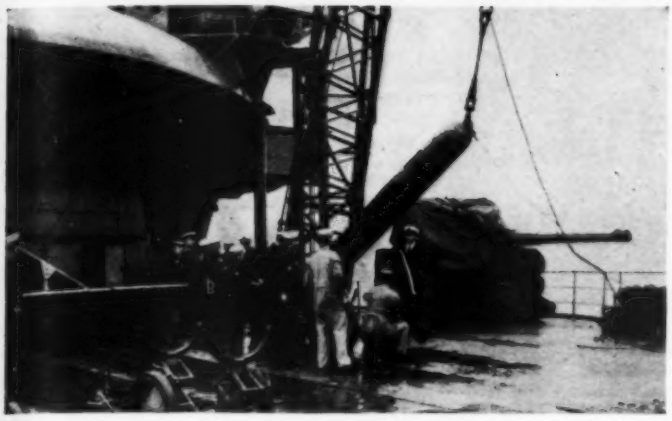
Target Practice in a Gale

The most difficult practice took place after a weather warning had been issued. The warning was in itself unusual: "Full gale and storm all coasts." Officers of the ship could not recall a similar warning combining full gale and storm. Nevertheless, flying went on. As it was a southerly gale the ship was sheltered to some extent by the Nairn and Banff coastline off which we steamed. But the clouds were tearing past in great ragged billows at about 6,000ft.; up there, where the wind was blowing at 50 knots, the aircraft were bombing the target, first from one direction, then from another. Under those extremely difficult conditions, one bomb struck and drilled a hole clean through the middle of the target—a thing unheard of in the history of the *Courageous*.

This target was a little solid wooden raft measuring about five feet by two and a half feet, and fitted with a kind of snow-plough prow which, when towed behind the ship, sent up a great white wave, visible from almost any height. That one of the 8½ lb. practice bombs struck this tiny object from 6,000ft. was certainly remarkable.

Most of the bombs dropped by the more experienced pilots and observers were reason-

A Swordfish coming to a standstill after alighting, with the arrestor gear stretched behind her. There is plenty of room for two in the rear cockpit.



A torpedo comes back on board *H.M.S. Courageous.*

ably close to the target, but those of some of the less experienced pilots and observers fell wide of the mark—one falling not far from the ship itself, about half a mile from the target. Accurate bombing requires considerable practice.

The dive bombing was more thrilling. The aircraft came down in a steepish dive, flattened out and released their bombs. The shooting was good, but it was again noticeable that the experienced pilots got consistently better results.

From the deck some 70ft. above the surface of the water it was possible to judge fairly accurately where the bombs fell, but to assess the value of the bombing something more was necessary. The bomb bursts were cross-plotted from the destroyer *Wren*, and also photographed from the air by aeroplanes detailed for the purpose. In the photographs the rings surrounding the places where the bombs hit the water can be seen, and this enables their points of contact with the surface to be plotted accurately.

"Wet-plate" Photography

One of the photographic machines provided the biggest thrill of the week. When alighting the pilot apparently thought he could pull up with his wheel brakes. The deck was wet with rain. The machine skidded. The pilot opened the throttle wide and went over the side of the ship forward of the palisades. Unfortunately he did not have enough speed to make a clear getaway. The Swordfish pancaked into the sea with a mighty splash. Almost instantly the Youngman dinghy burst through the upper wing without assistance from the crew, and the three men got into it unhurt. Within a few minutes the destroyer picked them up from the bobbing dinghy. The machine sank soon after.

The Youngman dinghy is inflated by a bottle of compressed carbon dioxide. The opening of the bottle is effected by a hydrostatic valve which operates on immersion to a depth of about 15 inches. The only real danger of non-operation of this dinghy seems to occur when an aeroplane crashes into the water in such a way that the valve-operating gear, or the dinghy itself, gets damaged, thus preventing the inflation gear from operating quickly enough or the pneumatic raft from bursting its way out of the wing. But in this instance the apparatus worked like a charm to prevent an alarming incident from becoming an unpleasant one.

In runner attacks the operation of diving on the target, levelling out, aiming and releasing the torpedo and turning away takes approximately a minute and a quarter. That does not leave much margain of time for the ship to counter the attack by anti-aircraft fire. True, it only takes something like eleven seconds to fuse, load and fire a normal A.A. shell. But to this must be added the time needed to spot the oncoming aircraft, estimate their speed and direction, and calculate the correct fuse setting, transmit orders to the guns' crews, and bring the guns into alignment. This presupposes that the ship has not been taken unawares and that the gun crews are at stations ready to go into action. And perhaps the odds may be twelve aircraft to one ship.

That is the problem. Until it is actually tried out in anger, it is not easy to calculate how effective anti-aircraft gunfire can be against aircraft attacking ships in this way. But of one thing I am sure: no ship is going to get many shells loosed off before the torpedoes are on their way. No doubt this is the reason why the Navy places considerable reliance upon its multiple pom-poms to ward off dive bombers and torpedo attackers. It is the old problem of doing one's best in a limited time.

There is one great difference between torpedo attack and dive bombing. The dive bomber must cross over or nearly over its target after releasing its bomb, for it is already close to it at the moment of release, and unless the pilot is prepared to continue his flight he may disturb the aim of the bomb aimer and also incur the risk of collision with another machine of his own formation. Torpedo attack, on the other hand, avoids crossing the target. The torpedo is dropped some distance from it. The pilot then has room to swerve round and get away low down on the water, probably in greater safety from the multiple pom-pom than the dive bomber.

Fighter Defence

It seems to me that torpedo attack from the air demands measures to repel it long before it gets within striking distance of its target. That should be the chief function of the fleet fighter, which should engage the torpedo bomber before its dive begins. Such air action may play a more important part in the safety of a fleet than protection by anti-aircraft gunfire at a later stage of the attack.

It would, therefore, appear desirable to equip every possible ship which can carry aircraft with a proportion of fighters. Ship fighters should subordinate speed to rate of climb and manœuvrability, for the torpedo-carrying aircraft cannot be as fast as the land bomber, and it may have to be chased down in a curving dive, when the ultra-fast monoplane would probably overshoot it.

Even if one makes allowance for the fact that modern naval construction must tend to minimise the effect of the bomb and torpedo, the number and weight of the missiles which find their target is of importance, for if a ship is disabled so that her speed is reduced her effectiveness as a fighting unit is diminished. And much time and money may have to be expended upon her before she is able to operate effectively again.

If every naval ship capable of carrying aircraft carries

Swordfish landing-on. An escort destroyer is seen in the distance.

Off—a Swordfish leaves the deck

at least one high-speed multi-gun fighter the pilots must be highly trained specialists of the type we knew in 1917 and 1918—men who were given roving commissions about the Western Front, charged with the duty of shooting down whatever enemy aircraft they came across. And if it is possible to form within the Fleet Air Arm a specialised air fighting corps of this kind, the Navy may go far to solve its problem of defending ships against air attack.

The most spectacular thing I saw was a night torpedo attack against the *Courageous* by the ship's own shore-based aircraft.

Dusk had fallen, all lights were out and all scuttles were closed. Our speed was relatively low—only a matter of 12 knots—but we were driving half into the teeth of a strong wind, and as we ploughed through the water great caps of white were thrown off on each side. But our bow and stern waves could not have been easy to discern from above, for the whole sea was whipped into foam by gusts of up to 40 and 45 knots.

Light on the Sea

Every now and then the flicking of the needle of the anemometer of the ship disclosed the velocity of the gusts. Then out of the night sky ahead, starless because of clouds, we heard the swelling drone of an engine. Soon a parachute flare was released dead ahead of the line on which we steamed. An eerie light of hundreds of thousands of candle power lit the sky and a great circle of sea. There could be no doubt that the watching eyes in the aircraft above could see us clearly. Instantly came an order to turn to starboard. Our head veered off and maintained that course for a few moments. Then came another order, and the ship swung back across her original course and away to port. Still we could hear the faint drone in the sky. But the slowly falling parachute flare was now well away to the right and travelling down the beam of the ship.

Followed a period of tense waiting. Then suddenly the faint flash of discharge appeared, and the sky away to the right was illuminated as another parachute flare broke into flaming light. But the light was drifting down wind away from us, and was so far off that it failed to light up the ship to the pilots and observers who were circling and waiting to attack when they could see their target clearly.

Two things defeated the attack that night: first, the manœuvres of the ship had been cleverly executed; and, secondly, the wind up aloft must have been in the order of 60 miles an hour. The high wind caused unusual drift both to flares and aircraft, and made bearings difficult. Although the ship was found, the attack failed because the ship was not subsequently illuminated in a manner which enabled the torpedo aircraft to attack.

The adequate illumination of the target at night is very important, because torpedoes must be launched from a relatively low height; unless the target is thus illuminated it is difficult for the pilots to see it. Apart from the reduced chance of hitting a poorly illuminated target there is the risk of the dive to a low height ending with a crash into the sea.

So the exercise was discontinued. "Undarken ship. On navigation lights" came the order from the bridge.

The Return Flight

The aircraft began their return flight to Evanton. Suddenly the ship's wireless intercepted a message from one of the aeroplanes stating it was lost. Its approximate position was quickly estimated from the bearing. Two searchlights were ordered to be projected to maximum elevation, while the ship gave out her own position by wireless. We gazed up into the starless, storm-wracked sky, wondering what might happen to the fellows who were lost, for there are mountains in the region of Helmsdale, some rising to about 3,000ft. There followed eight minutes of suspense. Then the ship intercepted the reassuring message "Found formation." Everyone heaved a sigh of relief.

An interesting attack was carried out against four ships of the 2nd Cruiser Squadron. These Southampton class cruiser of 9,100 tons displacement have extremely rapid acceleration and are capable of very quick manœuvring. They can put the helm hard over at full speed, and turn in about their own length.

The attackers were a squadron of Swordfish which took off from the *Courageous* and climbed up towards the clouds. We fetched in astern of the four cruisers to watch Signal flags ran up, and it was a lovely sight to see the ships open up to 25 knots. Not until I realised that they were steadily drawing ahead of us did I appreciate the speed at which they were moving through the water. We were batting along at 20 knots.

We suddenly spotted our aircraft through a gap in the clouds; the sunlight glinted on some of their polished metal; they were well astern, flying out of the sun at about 10,000ft. From their different angle farther ahead the cruisers did not see them and immediately afterwards we lost sight of them behind the clouds. We next spotted them just before they came tumbling down to the attack.

As the aeroplanes dived they dispersed about the sky to make themselves as difficult a target as possible Simultaneously the four cruisers manœuvred to avoid attack. Pirouetting round with astonishing ease, some to the right, some to the left, they obviously made it just a little more difficult for the aircraft pilots to swing accurately into final position for launching their torpedoes. Then we saw the splashes of the torpedoes hitting the water, and, in spite of the swift and unexpected manœuvres of the ships (the most experienced Fleet Air Arm pilot in the attacking aircraft told me that he had never seen those particular

A squadron ready to take-off for bombing practice.

manœuvres before) about half of the missiles found their mark.

Soon the cruisers were steaming back in line and the aircraft getting ready to alight. The *Courageous* was faced with the alternative of getting the aircraft back on deck or salving the torpedoes first. The former course was decided on, and so some of the ship's boats were lowered to collect torpedoes while we steamed off into wind to let the aircraft come on.

The salving of the torpedoes was interesting.

Bringing-in the Mouldies

For the purpose of practice attacks torpedoes are adjusted to run at a depth which will carry them safely under the hulls of the ships to be attacked. Photographs taken from the air disclose whether the torpedoes would have hit had they been running at the depth which would be used in war.

When the compressed air driving the motors is exhausted the torpedoes come to the surface, or should do so. Occasionally one may get damaged and sink. In the latter case a decision has to be taken whether the torpedo (which is an expensive article) should be salved or whether the cost of salvage is likely to be greater than the value of the damaged torpedo when brought up from the bottom.

The method of collecting from the bottom is to drag for it by means of a "Staybright," a name given to the drag because it is made of rustless steel. To drag for a torpedo the location of which is only approximately known means dealing with an area of some twenty square miles, and this is an operation which costs both time and money.

Fortunately, most of the practice torpedoes come to the surface. There they float, about a third of their length projecting out of the water, head up, and emitting a tiny vaporous curl of calcium gas as an SOS signal. At night the flame of the burning chemical serves as a position marker.

Boats are lowered. The crews lash the torpedoes alongside or trail them astern on a tow, and return to the ship. They are hoisted inboard by derrick, to be cleaned and recharged with compressed air for the next exercise.

Most visitors to aircraft carriers are content with the flying deck; certainly there is enough of interest and novelty there to warrant an extended stay, for the flying-off, landing-on, and the operations of the ship relative to the exercises carried out by the aircraft themselves, are of sufficient interest to make the flying deck of an aircraft carrier one of the most fascinating things which the Navy has to display.

But the flight deck is only one aspect of a carrier.

Below Decks

The *Courageous* houses four squadrons. So that those four squadrons can carry out the work required of them the ship carries a total complement of some 1,300 men. Their occupations are many and various.

There are guns' crews who have to handle the defensive armament with which the ship is fitted. The crews have to be practised in gun drill, range-finding and actual shooting—chiefly at sleeve targets drawn behind aircraft. Most of the anti-aircraft guns in the *Courageous* are 4.7in. high-angle guns which can fire very rapidly when required. During shooting practice the roar is shattering in the relatively confined space in which the guns are mounted; clocks are removed from the Wardroom walls, for everything shakes and rattles, particularly when the nearest guns are in use.

In the main engine-room a vast array of machinery and controls was crowded into a space relatively more confined than I have ever seen in a merchant ship of about equal size. The temperature was 82 degrees Fahrenheit.

The engines are oil-fired turbines. When flying is in progress orders from the bridge to the engine-room are given in r.p.m. of the engines, which enables the bridge to control the speed of the ship with extreme accuracy.

From the engine-room I went down to one of the boiler rooms. One man was in charge of each of the oil fuel feeds. He controlled the intensity of the flames that blazed through the little openings between steel slats, watching by means of a little mirror mounted overhead that there was no emission of smoke from the throat of the furnace. The training of these men takes something like a year.

I visited the refrigerator room. Its plant cools stores and magazines. In the hydraulic engine-room an hydraulic compressor hammered away with the peculiar action of its kind to provide power for operating aircraft lifts, guns, and the landing-on gear. There, too, was the compressor required to supply compressed air for torpedoes. For'ard was the store, and, deep down below it, almost in the bow of the ship, the electric generating plant was housed in a small, steel-walled chamber occupying the full width of the ship. Above all this concentrated medley of mechanism and men, steel ladders, lifts and gangways, were the upper and lower hangars for housing the aircraft; for safety the machines are usually lashed down at wing tips and tail to steel rings in the deck. Beyond the fore end of the lower hangar was the aircraft workshop, where engines and instruments are overhauled by mechanics of the R.A.F. and the R.N.

Situated curiously high up alongside one of the outside gangways connecting the officers' quarters and the bridge was the forge. I remember noting with perhaps rather unkind amusement the lugubrious expression on the faces of the men in the forge just after gunnery practice; all the dust of the forge had been shaken down from every nook and cranny and all the flakes shivered off steel so that the floor was covered with it; as I passed they were surveying the mess quizzically before beginning to sweep it up to make the place look reasonably tidy once again.

Ship's Headquarters

High above the bare expanse of the flying deck is the "island." Its superstructure surrounds the funnel. It contains the brains of the ship whence orders can be issued so that one man can co-ordinate and direct the activities of some 1,300 others. There are the wheel-house, the signals room, telegraphs, telephones, semaphores, sights, precision instruments, searchlights and a hundred and one different details. It is the H.Q. of the ship. There are to be found Captain, Navigator, Wing Commander and other officers. On the Captain's bridge is accomplished the work of directing the ship wherever she may be required to go. Navigation is carried out from the chart-room behind the Captain's bridge. Above it in the *Courageous* is the Admiral's bridge, a little open space with deck gratings and glass windshields round front and sides where, in the darkness of the night, there comes a sense of isolation from the great ship beneath.

How everything is packed below is a mystery. Where do men sleep? At night one finds in the steel passages hammocks slung from hooks. In them swathed figures look for all the world like Egyptian mummies.

Watch goes on day and night. So, during the day one finds men rolled up in blankets, stretched out on benches, on tables, snatching what sleep they may while the work of the ship proceeds around them.

And somewhere are the Commander's office, the Chaplain's office, the sick bay.

Yo Heave-Ho!

But, crowded as it is below, up on the flying deck there is room to move about in comfort and to breathe sweet fresh air but for the beastly smoke that sometimes blows from a galley funnel if the wind is wrong.

And up there in the evening a physical training class moves with concerted rhythm in the joy of exercise, the padre in the front rank.

There, too, recruits learn ship drill. Carrying flags, a small party of men wheels and turns, moves right and left, simultaneously altering the position of their flags to the instructor's orders. So recruits learn how ships act to signals.

And, when the bombing target is being hauled in, the Marines band comes up. Some 300 men line up on the after end of the flying deck. Doubling back and forth, they help pull in the cable, for the little power winch right for'ard is too small to pull in the target quickly. And as they run with the cable and double back to take another haul the band sets the time. As I watched them I smiled, for the tune the band leader had selected was "Happy Days Are Here Again."

BRITAIN n

The Big Aero Exhibition which Opens To-morrow : Britain's Aircraft Engine and Equipment Contribution

The Hawker Hurricane eight-gun fighter (left) will be shown in Paris with a De Havilland variable-pitch airscrew for its Rolls-Royce Merlin engine. Below is the Supermarine Spitfire, a rather smaller and faster type, also with the Merlin.

DURING a period of thirty years there have been held in the Grand Palais des Champs Elysées fifteen international aeronautical exhibitions. The sixteenth is to open its doors to-morrow morning, November 25, when M. Lebrun, the French President, will make a tour of inspection and declare the *XVIe Salon de l'Aviation* well and truly open. It will remain open until December 11.

The first was held in 1909, the year when Louis Bleriot first flew across the Channel. What a change we have seen since those "heroic" days of flying! And what a difference in the general outlook! The aeroplane has become commonplace as a means of transport and a military menace to most of the world.

That military aircraft types will predominate, as in most previous Paris Shows, is almost a foregone conclusion; in importance certainly, if not in actual numbers. The international flavour of what has too often been an almost exclusively French exhibition seems to be assured this year by the participation, on a fairly large scale, of Great Britain, Germany, Holland, Poland and the United States. It is to be hoped that this year no American aeroplane will be kept out because it is too large to pass through the doors, as happened to the Ford trimotor one year.

French exhibits will, as is but right and proper, be in the majority, and it is interesting, and perhaps significant, that not only the National Aircraft Factories, of the North, West, South-west, Middle, Centre and South-west (hence the expression "playing both ends against the middle"), but individual French constructors will be showing. One does find such famous names as Marcel Bloch, Louis Breguet, Caudron, Farman (Henry, Maurice and Dick), and Morane-Saulnier, among the exhibitors.

America will, it seems, be well represented if plans do not go astray. Among the well-known American names one finds Curtiss-Wright, Consolidated (via Fokker), Douglas (ditto) and United Aircraft Corporation.

Holland will, as on so many previous occasions, be represented by Fokker and Koolhoven, and Poland by the P.Z.L. national factory. Czechoslovakia's contribution seems to be provided by the Walter firm, who will presumably be confining themselves to engines.

Judged by numbers alone, the German section of the show should be impressive. No fewer than sixteen aircraft and glider firms figure in the German list, but of these it is to be feared that many will of necessity have to confine themselves to showing models, a somewhat disappointing ex-

n PARIS

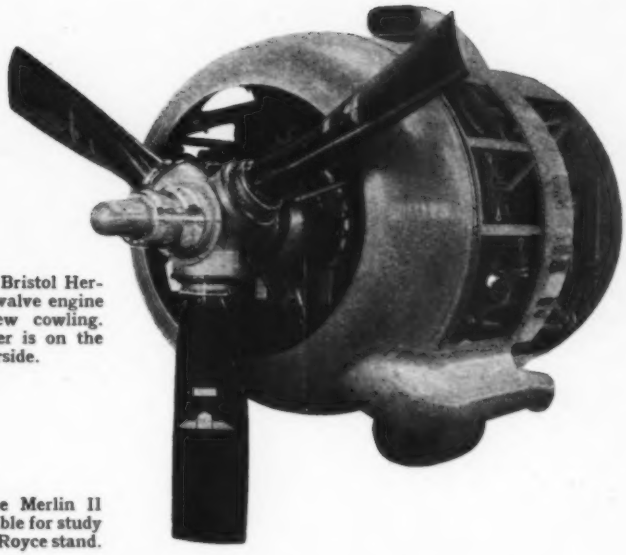
pedient. In the engine section Germany should make a fine showing with six engine firms represented. In addition, a large number of German concerns will show accessories and equipment.

Great Britain, with whose exhibits we deal in the following pages, is well represented in the matter of engines, although the full-size aeroplanes will impress by their quality rather than their numbers. The long-nosed Bristol Blenheim will invite comparison with the bombers shown by other nations, and Britain's fighter class will be worthily represented by the eight-gun Hawker Hurricane and the Vickers-Supermarine Spitfire. An official Air Ministry stand will be an innovation.

The Hurricane will be more or less standard except for the fact that its Rolls-Royce Merlin II engine will be fitted with a three-bladed De Havilland variable-pitch airscrew. Unlike the majority of the new military types, the Hurricane is fabric-covered and has girder-type construction. The standard Hurricane has a maximum speed of 335 m.p.h. at 17,500ft., climbs to 20,000ft. in 9 min. and lands, flaps down, at 62 m.p.h. A duration of nearly two hours at full throttle is attainable and the gross weight of the machine is about 6,000 lb. Dimensions are: Span 40ft. and length 31ft. 5in. and the wing area is 231.5 sq. ft.

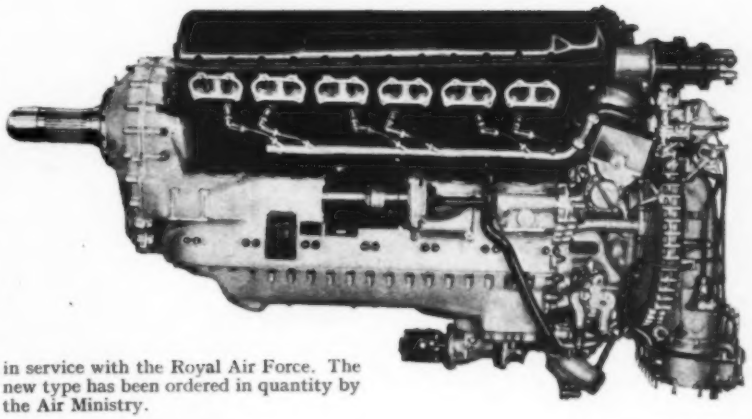
The Supermarine Spitfire, a smaller and faster type of all-metal construction, likewise mounts the Rolls-Royce Merlin II. It is expected that the first performance figures will be announced.

The special Bristol Blenheim has a modified nose (which gives improved facilities for navigation and bombing) and extra tanks in the wings, allowing a range of 1,900 miles. The maximum speed, with two Bristol Mercury VIII engines giving 930 h.p. for take-off with 100-octane fuel, is 295 m.p.h. Except for the new nose-piece, the machine resembles externally the Blenheim as now in service with the Royal Air Force. The new type has been ordered in quantity by the Air Ministry.



(Right) The Bristol Hercules sleeve-valve engine with its new cowling. The oil cooler is on the underside.

(Below) The Merlin II will be available for study on the Rolls-Royce stand.



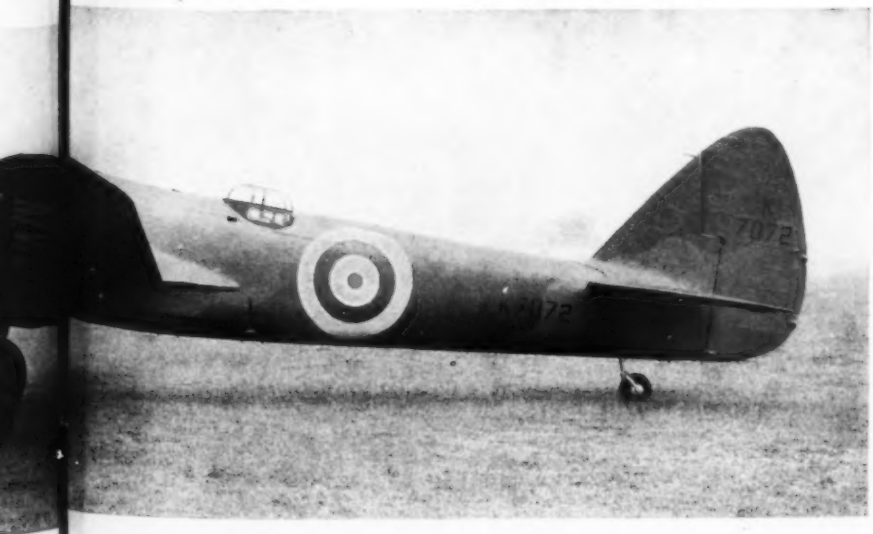
Engines

New engines will include a Bristol which cannot at the moment of writing be named, and perhaps a newcomer to the Rolls-Royce stand.

The Bristol Hercules 14-cylinder two-row sleeve-valve engine, which gives 1,375 h.p. in its present medium supercharged form, will be shown in its new cowling, which features an inlet of comparatively small diameter, controllable gills and complete detachability from the fire-proof bulkhead. The arrangement of the oil-cooler and single-outlet exhaust are interesting. A Rotol three-bladed constant-speed airscrew is fitted. The Hercules has a capacity of 38.7 litres, the overall diameter is 52in. and the maximum take-off power 1,290 h.p.

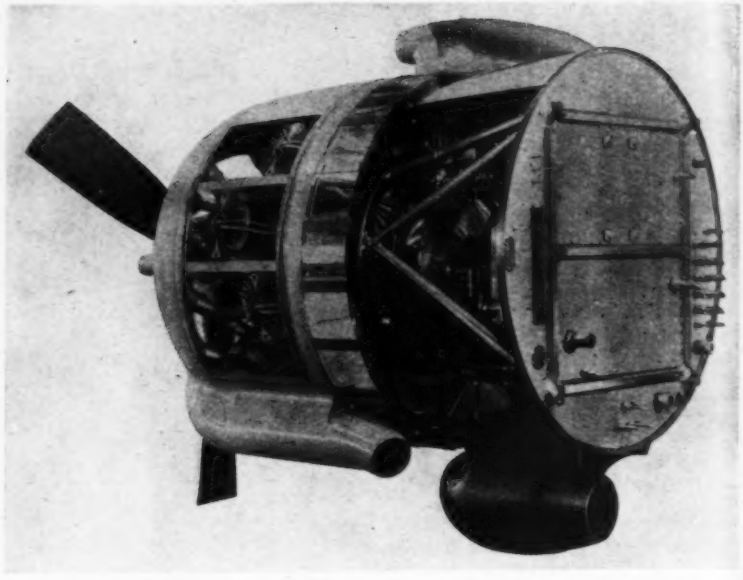
Poppet-valve engines will be represented by a Pegasus XVIII with two-speed supercharger (28.7 litres, 55.3in. diameter, 885 h.p. (max.) at 15,500ft. and 965 h.p. for take-off), and the Mercury VIII (24.9 litres, 51.5in. diameter) which has the following ratings: 725 h.p. for take-off (920 h.p. with 100-octane fuel), 840 h.p. (max.) at 14,000ft.

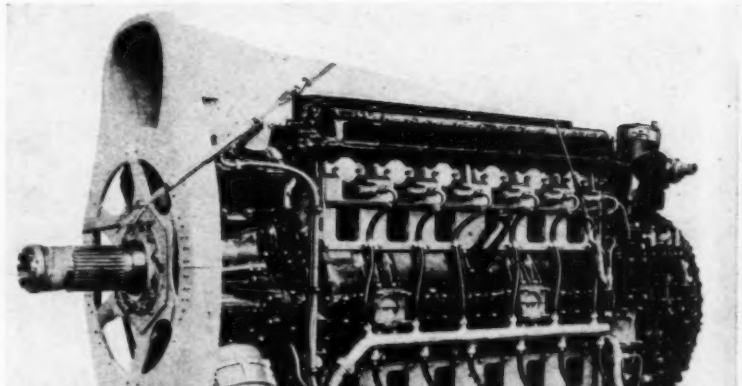
The Perseus sleeve-valve series will be represented by a Series XII engine which gives 830 h.p. for take-off and 905 h.p. (max.) at 6,500ft., has a capacity of

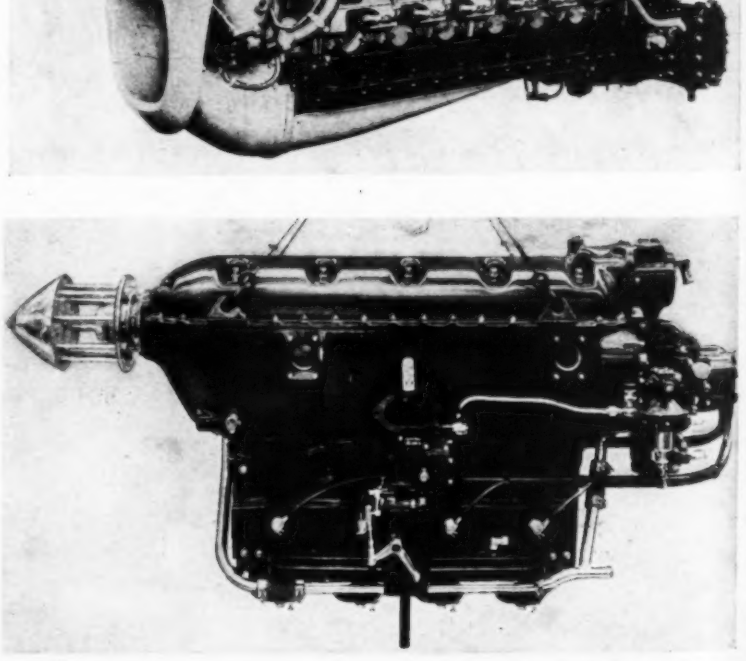


The long-nosed Bristol Blenheim, which has a range of 1,900 miles and a nominal maximum speed of 295 m.p.h., making it one of the most effective bombers in the world.

From top to bottom are another view of the Bristol Hercules, complete with Rotol airscrew, accessories, cowling and bulkhead mounting; the 1,000 h.p. 24-cylinder Napier Dagger VIII; and the 80/90 h.p. D.H. Gipsy Minor.







24.9 litres and is 52in. in diameter.

Then there will be a nine-cylinder Aquila giving a maximum output of 540 h.p. at 3,000 r.p.m. and 6,000ft. (600 h.p. for take-off), which has a capacity of 15.6 litres and an overall diameter of 46in.

The Rolls-Royce Merlin II, in which great interest is being displayed on the Continent, is a twelve-cylinder liquid-cooled vee rated at 990 h.p. at 12,250ft. and giving a maximum output of 1,030 h.p. at 16,250ft. These figures are obtained with fuel of 87-octane number.

Resplendent in black and red will be a De Havilland Gipsy Twelve (530 h.p. for take-off); a 205 h.p. Gipsy Six Series II; 130 h.p. Gipsy Major I; and 90 h.p. Gipsy Minor. Additionally, there will be a three-bladed Hydromatic size-5,000 quick-feathering airscrew; a standard 5,000-size three-bladed constant-speed airscrew; on the Gipsy Twelve there will be a two-blade 4,000-size airscrew with blades cut short; the Gipsy Six II will have a 1,000-size two-blader, also with clipped blades; and specially mounted on a table, with an electric motor causing it to change pitch on the two-pitch and constant-speed principles, will be a 1,000-size two-blader. A sectioned constant-speed governor unit will also be on view.

Models will be shown of the Albatross, Flamingo, Dragon Rapide, Tiger Moth, and Moth Minor aircraft.

The New Dagger

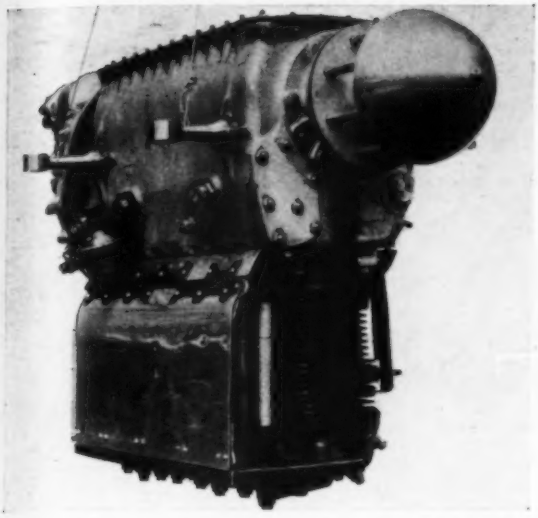
The Napier exhibit will comprise a Napier-Halford Dagger Series VIII and a Rapier Series VI with a selection of engine components to illustrate the quality of Napier workmanship.

The Dagger VIII is likely to prove an outstanding attraction, as it gives 1,000 h.p. at 8,750ft. at 4,200 r.p.m. and has a capacity of only 16.8 litres. Design features include a large double-entry supercharger, provision for a D.H. constant-speed airscrew, and a rearrangement of accessories, saving about 11in. in length as compared with older Daggers.

The extensive range of Armstrong Siddeley radials will be represented by a Tiger VIII 14-cylinder two-row engine with two-speed supercharger. This model is geared 0.594 to 1, is fitted with a Claudel Hobson A.I.T. 87 M.A. down-draught carburetter with automatic variable-datum boost control and automatic mixture control, and gives 920 h.p. for take-off. Typical of the outstandingly popular Cheetah range will be the Cheetah X seven-cylinder single-row model with Claudel Hobson A.V. 70 M. carburetter with variable-datum boost control and automatic mixture control. The take-off output of this engine, which has provision for the operation of a variable-pitch airscrew, is 375 h.p.

Also on the Siddeley stand will be a sectioned working model of the rear portion of the Tiger VIII engine showing the two-speed supercharger in section as well as the drives for the accessories and auxiliaries. The two-speed blower was described in detail in *Flight* last week.

The Blackburn-Cirrus exhibit will include a model of the Skua two-seater fleet-fighter dive bomber monoplane now in series production for the Fleet Air



The 50 h.p. Cirrus Midget (above) will make an interesting comparison with some of the new Continental light four-in-line units. On the right is the 350 h.p. Siddeley Cheetah X which is so much in demand for trainers and light military machines.

Arm, another of the Shark torpedo-spotter-reconnaissance biplane, and one of the B.2 Trainer. The complete range of Cirrus engines—Major 150, Minor, and Midget—will be represented. These models, respectively, give maximum powers of 150 h.p., 90 h.p., and 55 h.p., and their weights in the same order are 325 lb., 227 lb., and 165 lb. All are inverted four-in-line units of robust construction.

Accessories and Equipment

Aircraft Components, Ltd., will have as a central feature of their stand a complete Dowty retractable undercarriage for an aeroplane of 15,500 lb. gross weight. There will also be a retractable tail wheel unit suitable for a machine of 20,000 lb. gross weight. In this design the retracting cylinder is mounted on the strut itself in such a way that free travel of the jack automatically locks the unit in the safe landing position, and unlocks it for retraction.

Thirdly, there will be shown the Dowty preselector automatic flap control, in which the movement of the flap, landing lights, radiator shutter, or other component is indicated exactly by the position of the operating lever, thus making a separate indicator unnecessary.

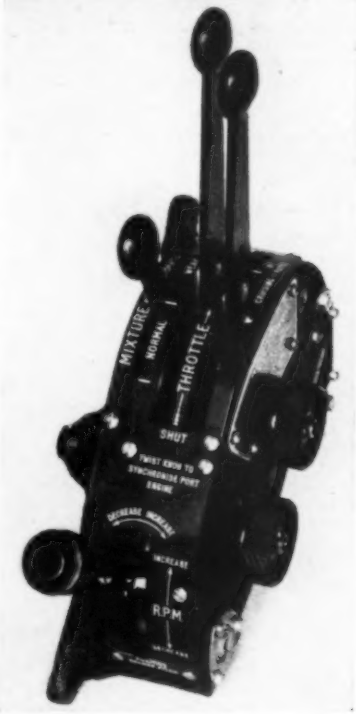
Aviation Engineering (Messier) Co., Ltd., will be co-operating with their French company, on whose stand their undercarriage equipment will be shown.

Avimo, Ltd., will be represented on the stand of Société Bronzavia, for whose products (engine accessories, oxygen equipment, etc.) they hold the British manufacturing rights.

The Dunlop Rubber Co., Ltd., will have an exhibit consisting of a 26.00-26 tyre and wheel; a pneumatic brake and gun gear demonstration stand; and a hydraulic brake, gun and water-rudder demonstration stand.

On the pneumatic stand is demonstrated the operation of brakes and guns by means of compressed air. In the case of the brakes the system is operated by a lever situated on the control column, and differential braking is given by means of the differential control unit being coupled to the rudder bar. The gun system is operated by a button on the control column and can operate simultaneously any number of outboard guns. The system can also be employed for the operation of airscrew-synchronised guns.

The hydraulic stand demonstrates the hydraulic system for the operation of brakes, guns and water rudder. A hydraulic differential control and brake units are coupled to the undercarriage power supply and differentially controlled by the unit being coupled to the rudder bar. Application is through the hand lever on the control column.



Hobson control for twin-engined aircraft with interlocked throttle and mixture levers and synchronising device for constant-speed airscrews

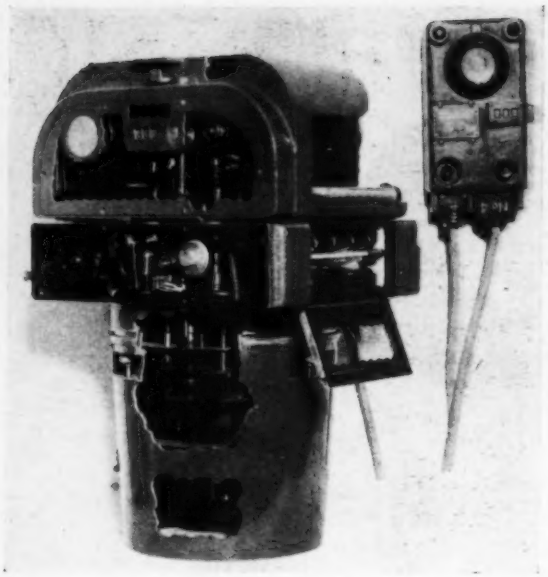
The gun system consists of hydraulic firing and cocking units for shell-gun and machine guns. The firing units on the shell-gun and machine guns are coupled together and are operated by a button on the control column through a safety valve and also an operating valve. The former valve is coupled in the undercarriage circuit so that the guns can only be fired when the undercarriage is retracted.

The water rudder unit consists of hydraulic jacks and operating units and is operated from a unit controlled from the rudder bar.

Dzus Fasteners (Europe), Ltd., a sister company of Thomas P. Headland, Ltd., of London, the engineering factors, will be demonstrating their well-known self-locking fastener for use on cowlings, inspection flaps, fairings, etc.

Gallay, Ltd., will show for the first time their new "aerodynamic system" of liquid-cooling for engines of high-speed aircraft. They will also exhibit a representative selection of their normal engine-cooling equipment, including a radiator and oil cooler as used for the Merlin engine of the Fairey Battle; dual-stage oil cooler for the Gipsy Twelve engine as used in the Albatross; combined oil cooler and tank used in the Airspeed Oxford (Armstrong Siddeley Cheetah); standard-type oil coolers for hydraulic systems; combined oil cooler and cockpit heaters for the Gloster Gladiator (Bristol Mercury); cabin heating and ventilating equipment as used in the Handley Page Harrow; protected fuel tank for the Airspeed Envoy; and an air heater and steam boiler for the cabin-warming installation of the De Havilland Albatross.

H. M. Hobson (Aircraft and Motor Components), Ltd.—Few visitors to the Paris Show will need an introduction to this firm's products, which are such important features of the majority of British aircraft engines in use to-day. The equipment on show will include various types of aircraft carburetters, with examples of the Hobson Master Con-



(Left) The sectioned Williamson Eagle IV aircraft camera and its remote control unit.

(Right) Smith's Husun P.4L. inverted compass, read by means of a mirror.

trol variety; automatic mixture controls and boost controls; cockpit controls; ice-warning units for induction systems; compressed-air-operated fuel pumps; pressure and depression gauges for engine test beds; and the B.H. engine-driven high-pressure pump for gun turrets, undercarriages, etc.

Imperial Airways will, as usual, have a stand indicating the scope and progress of their operations.

Lodge Plugs, Ltd., will show their various types and sizes of aircraft sparking plugs in screened and unscreened types, together with terminal and screening equipment.

D. Napier and Son, Ltd., in addition to showing the engines already mentioned, will display the new Napier air compressor, for aircraft installation.

P.B. Deviator, Ltd., are showing a working model of the P.B. automatic pilot with automatic radio D/F. control. The basis of the apparatus is a P.B. automatic rudder and elevator control governed by a stabilised gyroscope with both hydraulic drive and servo action. This is electrically coupled to a Marconi D/F. receiver with a switch unit embodying a relay whereby signals from any radio station within the wave-range of the receiver are amplified to operate by electro-magnetic influences on the gyro axis, thus ensuring automatic navigation in accordance with the signal received. It is also possible that a blind-landing attachment will be exhibited, embodying an infra-red light detector capable of super control of the apparatus independently or in parallel with the D/F. equipment.

Rotol Airscrews, Ltd., are likely to show examples of their constant-speed, full-feathering and non-feathering airscrews (hydraulic or electric operation) for engines of 800 h.p. and upwards. An example will be seen installed on the cowled Bristol Hercules sleeve-valve engine on the Bristol stand.

Short and Mason, Ltd., will have a representative display of their aircraft instruments and test apparatus. The instruments, for civil and military aircraft, will be displayed on demonstration panels. The instruments will include compasses, altigraphs, and air-speed recorders. There will be various kinds of test apparatus, and also meteorological instruments.

Simmonds Aerocessories will be represented by their associated company in France, Aerocessoires-Simmonds, who will be exhibiting the following well-known Simmonds products: elastic stop nuts; Goudime navigational instruments; cowling clips; Theed hydraulic flap controls; Wondegrip non-slip flooring; and electric and hydraulic contents gauges.

Smith's Aircraft Instruments.—Among the wide range of instruments and accessories which Smith's are exhibiting are several new items. There is, for instance, the undercarriage position indicator, which is now being standardised in many types of aircraft. It includes a stand-by set of lamps, and is fitted with a screening device for night flying.

Again, there is the Smith remote-reading equipment, recently put on the market to meet the necessity for indicating on the instrument panel the movements of such devices as flaps, retractable undercarriages, petrol float mechanisms, and many others in which a remote indicator is necessary. It is electrically operated and consists of two units—an indicator and a transmitter joined by 5-core cable.

Thirdly, there is the Smith sensitive altimeter, which embodies a number of features making for extreme accuracy and sensitivity.

Automatic Pilot

The Smith automatic pilot will not be seen on this stand, but it is being exhibited by Jaeger Aviation S.A., who manufacture it under licence in France.

On the Smith stand will be a range of Husun compasses and navigation instruments. Among them the well-known type P.4, its new modified form P.4L. and the P.7 pattern, providing the pilot with a vertical card image. Another compass which is of particular interest is the P.4L. inverted type, in which observations are made by means of a mirror that, in some types of aircraft, may be mounted more conveniently than the compass itself.

Another item will be the Husun Mk.XII averaging sextant.

The navigation instruments of interest include the Addison-Luard course and distance calculator, the Dalton computer Mk.VII and the Bygrave position-line slide-rule.

Sperry Gyroscope Co., Ltd.—This firm will not be directly represented, but its instruments, such as artificial horizons and directional gyros, will be found in numerous aircraft of various nationalities, including the Hawker Hurricane. On the transatlantic Farman are four Sperry instruments in a special panel. Sperry panels will also be seen on the French Air Ministry stand.

Standard Telephones and Cables, Ltd., will show representative types of their aircraft radio equipment. These will include the Standard beacon transmitter, designed for airport and similar services, and capable of sending out predetermined code signals at regular intervals governed by a chronometer. An alarm system to indicate interruption of transmission is included. The set may be used for C.W. or telephony transmissions.

Another item will be a blind-approach receiver for aircraft use in conjunction with the Lorenz system. There will also be the type R.9 direction finder and homing device, providing three services: D/F. facilities on all types of signal with both aural and visual indication; homing on broadcast stations or other signal sources; and loop reception of normal traffic signals. The well-known standard Adcock D/F. system will be exhibited; this is specially designed to be free from night effect and aircraft error and, in addition, provides non-directional reception on all types of signal.

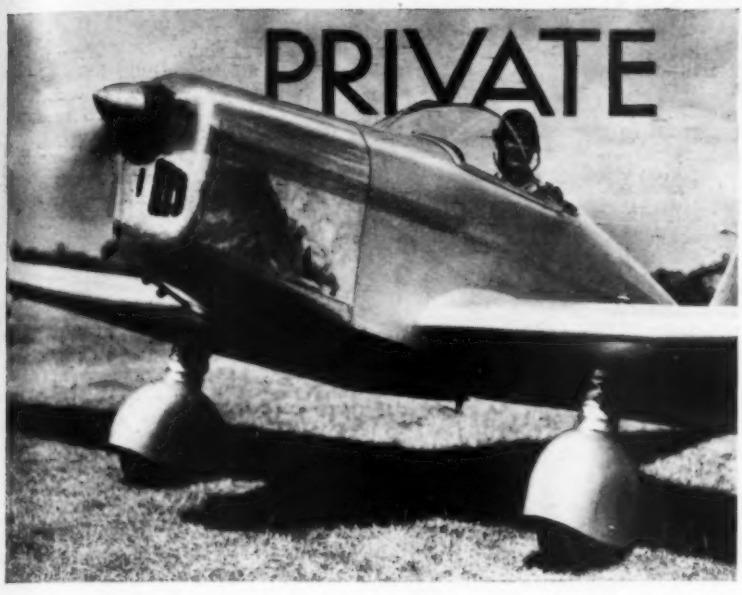
Other apparatus on show will include a short-wave transmitter unit primarily designed to work on six pre-set frequencies; a seven-valve superheterodyne medium-wave receiver with single-dial tuning; and the well-known R.10 short-wave fighter equipment, operating on four crystal-controlled channels in the short-wave band.

Tecalemit, Ltd., will be represented by the Paris Tecalemit organisation.

The Triplex Safety Glass Co., Ltd., will be represented by their French company.

The Williamson Manufacturing Co., Ltd., will have their stand wired up so that each model in their famous range of aircraft cameras can be demonstrated in operation. The exhibits will include Eagle aircraft cameras, the hand-held P.15 type, pistol cameras, and also several types of gun camera. Perhaps the most interesting exhibit will be a sectioned model of the Eagle IV camera with its mechanism completely exposed so that the whole cycle of operations may be seen. This camera takes 18 x 24 cm. pictures on roll film, and the magazine can accommodate a 200-exposure film. Control of exposures is effected through a remote instrument which can be fixed to any convenient part of the aeroplane at any desired distance from the camera.

The Zenith Carburetter Co., Ltd., will be represented by their French company.



PRIVATE FLYING

Topics of the Day

Why Criticise?

LOOKING back over the past few months I have sometimes felt in weak moments that my remarks about the Civil Air Guard scheme have been a little too persistently critical. Perhaps they have, and various people have, in fact, suggested that I was being rather unfair about a scheme which had not, after all, yet been given a chance to show its true value.

In all this disparaging comment my main (if forlorn) idea was to get the details of the scheme changed before everybody concerned had lost their interest in it. The need for providing the clubs with some new and special assistance has been obvious during the last two or three years, and I have done my share of crying in the wilderness, but at the same time this assistance had to be arranged in a form which would be vitally useful. Somehow or other, too, the best results had got to be obtained from the normal club material without either regimentation or sloppiness.

To attempt, in so doing, to arrange for a supplementary reserve of pilots was the obvious thing to do. My claim (and to some extent that of the journal which suffers my outpourings) has been that the assistance, as offered, did not do what it should do. It seemed to me to be no use at all to give thousands of people ten hours' solo flying each, while there was already a nucleus of comparatively experienced amateurs who were being given no assistance whatever.

Some of these amateurs have done anything up to a thousand hours or more of useful flying all over this country and the Continent, and they have always appeared to me to be the people who should first of all be helped and encouraged. Later, when this nucleus was well on its way towards being provided with experience of a new kind which would make them useful in case of emergency, the newcomers, more carefully selected, perhaps, than is usual in club circumstances, could be brought into the scheme.

As it is, the whole idea seems to have been worked out the wrong way round. First of all we are obtaining a lot of ten-hour pilots and later, perhaps, the old-stagers may, with luck, be given something for which they have been shouting during the last few years. There was never anything the matter with the basic idea, but only with the scheme as it was first produced—and in a great hurry, at that.

Even so, by virtue of the tremendous amount of work put in and the enthusiasm of the Commissioners, a very fair success is being made of the scheme as it stands, and we must all hand bouquets both to the Commissioners themselves and to the clubs which have really got down to the job. New pilots are being trained—though goodness knows what they are each going to feel at the end of their ten hours. And I am not forgetting that the average hourage figure of pre-C.A.G. members was less than this. That is neither here nor there.

Reformation

NOW, it seems—though nothing official has yet been announced—changes are to be made by which C.A.G. pilots in certain categories will be given a real chance. Those of Service age may be able to continue their training well beyond the ten-hour mark, and may even be permitted to fly rather more advanced types than those available at the clubs. Even the long-forgotten older pilots will possibly be given special training to qualify as instructors or to do other useful work.

Nobody, at least at the time of writing, can tell me the form which the special training will take, if at all, but I know dozens of amateurs who are quite capable of doing useful work and who would, in some cases, be able to tell the Service pilot quite a lot about his job. That is, the job of flying as such, and not, of course, about armament and the like. Some of them, especially those who have taken a real interest in flying throughout the last ten years, know a great deal more than some of the Service pilots about the technique of flying modern types. For one reason or another, the average Service pilot, sad though it is to admit it, never appears to have taken any particular interest in such things as blind-approach methods and radio navigation in general.

This seems to be the fault of the Air Ministry selection committee, which may be inclined to choose healthy rather than over-intelligent individuals. Not that the selection people do not know exactly what they want, but it is simply the way of things, and until comparatively recently the business of flying a military aeroplane did not actually demand any great technical or theoretical knowledge.

Making Use of Us

ALREADY, by the efforts of those concerned with it, the C.A.G. scheme has ceased to be the semi-political publicity campaign which so many people originally thought it, and it may even become a really useful second reserve.

Useful, that is, so long as an attempt is made to select the applicants on rather new lines. Just for once the ordinary standards of competency ought to be forgotten and different pilots chosen carefully for different duties. That is the basis of a real national register. Even the man who is over-age and who would not, perhaps, pass the somewhat stringent Service medical tests, can still be found a place in the scheme of things. The modern aeroplane does not necessarily require carefully moulded and standardised young men for its crew, but rather requires intelligent technicians who are simply fit enough to stand the rigours of high-altitude aerobatic flying. How many present-day transport pilots can run a mile, and how many Service pilots can read a block-to-block average or power-output chart?

Just as soon as a few obsolescent Service types are available there is a useful nucleus of pilots in nearly every club each of whom can, with only an hour or so of dual, handle these machines quite satisfactorily and so prepare themselves for up-to-date machines which they may or may not

Private Flying

have to fly in the distant future. Ideas change on these matters, and the type which might have been considered to be "for experts only" a few years ago, is now looked on as a somewhat fool-proof intermediate trainer.

Years ago Service people tended to be a bit superior about the likely capabilities of pilots in the Auxiliary Air Force, but some of the A.A.F. squadrons have not only proved themselves, but the pilots concerned are even going to have the chance shortly of flying almost the most up-to-date single-seater fighters. Amateurs in the widest sense, such as these, are no more likely to be supermen than some of the pilots in the much-despised clubs.

Ten years ago the average amateur would have shied at the thought of being asked to fly any one of the modern types with comparatively high wing-loadings, but nowadays they think nothing of it. Possibly aeroplanes are getting better, but certainly there has been a good deal of superior nonsense talked by self-appointed experts in the years gone by. Not every fool can fly, but most of them can—myself included.

INDICATOR.

FROM the CLUBS and SCHOOLS

ABERDEEN

CIVIL Air Guard members flew 22 hr. last week in spite of unfavourable weather. Several members are approaching the solo stage.

EXETER

Bad weather allowed only five half-days of flying last week during which 17 hr. were flown. C.A.G. enrolments now total 56.

PLYMOUTH

A fortnight of exceptionally poor weather resulted in only four possible flying half-days. Flying time was 10 hr.

THANET

Eight possible flying half-days out of fourteen resulted in 12 hr. 50 min. being flown. C.A.G. enrolments now total 56.

STRATHTAY

Only 20 hr. were flown in the first fortnight of November owing to gale and fog. Mr. A. J. Cook has qualified for his "A" licence.

WESTON-SUPER-MARE

During last week there were 12 possible flying half-days. 12 hr. 45 min. were flown by the club. C.A.G. enrolments total 42.

YORK AND LEEMING

During the first three weeks of November 69 hr. were flown by C.A.G. members. Miss Strickland and J. H. Perrin have now gone solo.

NEWCASTLE

Club flying time for last week amounted to 12 hr. C.A.G. members flew 30 hr. The annual dinner will be held on December 9.

READING

Two days of fog last week tended to reduce flying times, but an improvement in weather conditions towards the end of the week evened matters out.

IPSWICH

Owing to early morning fog most of the flying has been done during the short afternoons. Flying time for the first three weeks of November amounted to 15 hr.

C.A.S.C.

Twelve members attended the aerodrome last week-end. Heavy rain and high winds restricted flying, although 2 hr. 30 min. were recorded.

LONDON AIR PARK

The flying time for last week amounted to 60 hr. Messrs. H. Marshall, A. Cameron, R. Cowdry, K. Kemp-Turner and Mrs. D. Paterson have now obtained their "A" licences. Messrs. T. Mercer and I. Kingshott have now gone solo.

SHOREHAM

Whenever the weather has permitted flying all the club's machines have been booked up. Mr. J. Amis, of the Civil Air Guard, has gone solo. A dinner-dance will be held on December 31.

PORTSMOUTH

Over 91 hr. were flown by C.A.G. members last week, while club members flew 50 hr. Thirty-one C.A.G. members are now flying solo, while a total of 112 are under instruction.

MARSHALLS', CAMBRIDGE

The club flying time during the past week amounted to 83 hr. Two D.H. Moths have been added to the club's fleet. Mr. R. G. Bowles, of the C.A.G., has qualified for his "A" licence.

YAPTON

A total of 56 C.A.G. members are now under instruction, of whom eight have gone solo. Last week 59 hr. were recorded. Club flying brought this total up to 81 hr.

HERTS AND ESSEX

Rough weather during the last fortnight reduced flying times to the total of 146 hr. Seven C.A.G. members have gone solo. Mr. F. D. Wallace is welcomed as a new member. On December 1 the club's annual dinner and dance will be held.

YORKSHIRE

During the past week 42 hr. were flown in spite of bad weather. Messrs. A. R. Pigg, N. G. Baxter, and W. Carr-Birkbeck have gone solo—all three are C.A.G. members.

CINQUE PORTS

The flying for last week amounted to 29 hr. owing to poor weather conditions. In spite of this Mr. Mallorie completed his "B" licence cross-country tests and Mr. I. Campbell his night flight. C.A.G. members should note that lectures are now being given.

BROOKLANDS

During the past week Messrs. J. J. Dykes, J. North, I. L. Carr, Kahn, E. S. Harries, and Whaley passed their "A" licence tests, while Mr. B. S. Smallman received his instructor's endorsement. Over 30 Air Defence Cadet Corps applicants were interviewed.

WITNEY

Although during the first three weeks of November there was no flying on five days over 100 hr. were flown by members. Messrs. E. Crossley, H. Beyers and C. L. Ward have passed their "A" licences, while E. C. Blower has gone solo. A further ten pupils have been admitted for C.A.G. training.

LONDON

Although two days of last week were unsuitable for flying over 63 hr. were flown. Messrs. J. H. Balmer, G. W. Hodding and R. H. Jagger have gone solo, while Mr. C. L. Lewis-Hall has completed his "A" licence tests. The club's annual dinner and dance will be held at the Park Lane Hotel, Piccadilly, on December 16.

BEDFORD

Messrs. W. S. Howgate, I. Marshall, W. D. Crew, R. V. Watson, and Miss Y. Newman have now gone solo. Eleven new members have joined the club. Over 200 C.A.G. members attended the Clubhouse last week, when arrangements were made for advanced lectures. Mr. J. L. Stanton has been appointed chief ground engineer.

FOUR-CLUB CONVENTION

THAT there would be a job in the air for every Civil Air Guard pilot in the event of war was one of the several points made by Air Comdre. J. A. Chamier in a speech at Grosvenor House last Friday evening.

The occasion was the annual gathering of the four flying clubs in the Brooklands group. Each year members of the Brooklands, Cinque Ports, Northamptonshire and South Coast flying clubs have joined forces to hold a first-class party in London. Last Friday's event was even cheerier than its predecessors. "The Skipper," alias Capt. Duncan Davis, presided, and was, in turn, almost presided over by a faultlessly efficient toast-master. Capt. Davis confined his remarks to the progress made by the various clubs. At Brooklands, he said, the club-house had been successfully run by the club for a year. He attributed its success to the secretary, Mr. B. A. Smallman. After regretting (amid applause) that Brooklands was forced to turn down the C.A.G. scheme, he went on to stress the good work achieved by Mrs. Ann Davis at Lympne. Passing on to the Northants Club, he pointed out that since it had joined forces with the East Midlands Club instruction had been so brisk that they had applied for another instructor. The South Coast folk, under the leadership of Mr. Pashley, had put in a similar request.

With regard to the Air Defence Cadet Corps, said Capt. Davis, they had already collected £500 from friends, but he would leave it to Air Comdre. Chamier to explain the Corps' purpose. The Air Commodore, after emphasising the objects of the C.A.G. scheme already mentioned, then went on to explain how there was no Air Force scheme on the lines of the Territorial Army until the recent formation of the Air Defence Cadet Corps. He mentioned that over 2,000 had joined already, and hoped that by the end of 1939 the number would total 20,000. The object was to establish 180 squadrons.

After these two speeches the party danced to Sydney Lipton's Band and later gathered around the stage to enjoy listening to an enjoyably intimate Mr. Ronald Frankau.

THE LONG-RANGE WELLESLEYS at Ismailia before their record flight.

SERVICE AVIATION

Royal Air Force and Official Announcements :

Fleet Air Arm News : Military Aviation Abroad

King Carol at Odiham

KING CAROL OF RUMANIA, accompanied by Crown Prince Michael, paid a visit to Odiham station on Thursday, November 17. He was received by Sir Kingsley Wood and Air Chief Marshal Sir Cyril Newall (Chief of the Air Staff), and other senior officers were also present. His Majesty inspected a Hurricane, a Whitley, a Battle, a Hampden, a Spitfire, a Wellington, a Lysander and a Blenheim, each of which flew past in turn. Two flights of Hurricanes performed air drill, and a balloon barrage was demonstrated by No. 904 (Balloon) Squadron.

A New Group Commander

THE Air Ministry announces the appointment of Air Comdre. Thomas Edward Barham Howe, C.B.E., A.F.C., to assume command of No. 17 (Training) Group in the Coastal Command, with effect from a date in the present month.

Air Comdre. Howe was commissioned in the Royal Naval Air Service as a Flight Sub-Lieutenant in 1916, having served in the Australian Imperial Force since October, 1914; and for valuable flying services rendered during the Great War was awarded the Air Force Cross, as well as being mentioned in despatches.

From September, 1919, until January, 1923, he served at the School of Air Pilotage, and for valuable flying services at the School was awarded a bar to the Air Force Cross in the New Year Honours List, 1923. After a year in command of No. 32 Squadron, Air Comdre. Howe passed a course at the Royal Air Force Staff College. In January, 1929, he was appointed commandant of Station Headquarters, Northolt; and later that year was appointed to command No. 203 (Flying Boat) Squadron in Iraq. After his return to the United Kingdom in 1930, Air Comdre. Howe was employed on Air Staff duties in the Directorate of Training at the Air Ministry, until September, 1933, when he was posted to Headquarters Fighting Area, as Officer-in-Charge of Administration, and later as Senior Equipment Staff Officer. Air Comdre. Howe held the appointment of Air Attaché at Washington from September, 1935, until the end of 1937, when he was appointed Senior Air Staff Officer at Headquarters, No. 12 (Fighter) Group. In the New Year Honours List, 1936, he was appointed a Commander of the Order of the British Empire.

He was promoted to Squadron Leader in 1924, to Wing Commander in 1928, to Group Captain in 1933, and to his present rank on July 1, 1937. He acted as additional Air Aide-de-Camp to His late Majesty King George V from January, 1934, until August, 1935.

Long-range Wellingtons?

WING COMMANDER GAYFORD, who, as Officer Commanding the Long-Range Development Unit, was responsible for a great deal of the organisation of the non-stop record-breaking flight of the three Wellesleys to Australia, is reported to have said that it might be possible to fly non-stop from England to Australia in specially prepared Vickers Wellington twin-engined bombers. Single-engined machines, he said, were desirable on account of fuel economy on a record attempt, but they were not ideal for such flights, adding that future attempts would be made with two-engined machines capable of flying with one power unit out of action.

This statement gives a clue to the potentialities of the Wellington which, as now being issued to bomber squadrons, is fitted with two Bristol Pegasus XVIII engines with two-speed superchargers. Alternative power units are the Bristol Hercules and the Rolls-Royce Merlin.

As a specially developed long-range machine the Wellington would offer much more comfortable accommodation for the crew than does the Wellesley.

Incidentally, the crews of the long-range Wellesleys met with a great ovation in Sydney on arrival from Brisbane last week. They were welcomed by Mr. Stevens, Premier of New South Wales, and were given an escort of R.A.A.F. machines.

A New Command

THE Air Ministry announces the appointment of A.V-M. Owen Tudor Boyd, O.B.E., M.C., A.F.C., to be Air Officer Commanding Balloon Command with effect from November 7.

A.V-M. Boyd, born in 1889, entered the Indian Army as a 2nd Lieutenant in 1909, and was attached to the Royal Flying Corps in 1916 after graduating at the Central Flying School. During the Great War he served in France and Mesopotamia, being in command of various units, and for his services was awarded the O.B.E., M.C., and A.F.C.

After the Great War he served on air staff duties at the Air Ministry, and was appointed to command in turn a squadron and the School of Army Co-operation. In 1926 he attended a course at the Army Staff College, Camberley, and in 1928 was appointed Instructor there in Air Staff duties. He was subsequently appointed Deputy Director of Staff Duties at the Air Ministry, and towards the end of 1931 proceeded to Aden as Officer Commanding the British Forces in Aden. After his return to England in 1934 he was employed as Senior Air Staff Officer, at Headquarters, Fighting Area, until November, 1935, when he was appointed to command Central Area (renamed No. 1 (Bomber) Group, in May, 1936). Since December, 1936, he has been Director of Personal Services at the Air Ministry. He was promoted to Wing Commander in 1923, to Group Captain in 1930, to Air Commodore in 1934, and to his present rank in July, 1937.

Air Ministry Organisation

A NEW directorate has been formed in the Department of the Chief of the Air Staff, entitled "Directorate of Operations (Naval Co-operation)." Its task, presumably, will be to correlate the work of general reconnaissance squadrons with the work of the Fleet in Home waters. The Deputy Director is Wing Cdr. A. H. Wann, a former airship officer who survived the destruction of R.38 in the Humber in 1921.

The Deputy Directorate of Operations has been divided into two, one to supervise operations at Home and the other for Overseas.

The Directorate of Equipment has been organised in four Deputy Dircetorates instead of three as formerly.

Flying Accidents

THE Air Ministry regrets to announce the following accidents:—

F/O. Robert Duncan Tate (pilot), Cpl. Hedley George Kennett and A/C.1 Robert Cyril Salter lost their lives in an accident which occurred at Rugeley, Staffs, on November 12 to an aircraft of No. 139 (Bomber) Squadron.

A/C.1 Sydney David McNaughton died in the Hull Royal Infirmary on November 14, as the result of injuries received in an accident which occurred the same day at Patrington, Yorkshire, to an aircraft of No. 144 (Bomber) Squadron, Hemswell, Lincolnshire. F/O. Frank Cunniff Stibbard, the pilot, was slightly injured.

Sgt. William Arthur Curl (pilot) and A/C.1 Joseph Millican are missing and are believed to have lost their lives as the result of an accident off the coast near Alnmouth on November 14, 1938, to an aircraft of No. 7 A.T.S., Acklington, Northumberland.

Wing Cdr. Harry Augustus Smith (pilot) and P/O. Aubrey Ward Jackson lost their lives in an accident which occurred at Stradishall on November 14 to an aircraft of No. 9 (Bomber) Squadron, Stradishall, Suffolk.

Sgt. Arthur Jevon Tebbs (pilot, flying solo) died in the Military General Hospital, Haifa, on November 18 as the result of injuries received in an accident which occurred near Nablus, Palestine, on November 10, 1938, to an aircraft of No. 33 (Fighter) Squadron, Ismailia, Egypt.

F/O. Peter Marshall Hamilton-Hall (flying solo) lost his life in an accident which occurred at Laurencekirk, Kincardineshire, on November 16 to an aircraft of the R.A.F. Station, Lee-on-the-Solent.

SERVICE AVIATION (CONTINUED)

Provision for Blind Landing

IT is stated that the Air Ministry has decided to equip forty R.A.F. stations with apparatus for landing in conditions of bad visibility. We understand that the Lorenz system has been chosen.

R.N.V.R. (Air Branch)

THE Admiralty has issued *Regulations concerning Commissions in the Royal Naval Volunteer Reserve (Air Branch)*. Both pilots and observers are wanted, and all candidates who are accepted will be required to spend an initial period of 18 months in full-time training. Pay will be given during this period, and on completion of it a gratuity of £75 will be granted. A further gratuity of £75 will be granted if the officers pass the prescribed tests or examinations at the end of the course. Thereafter they will receive £25 per annum. An outfit gratuity of £25 is also allowed.

Air Observer School at Acklington

THE second Royal Air Force air observer school devoted to armament training opened its first course last Monday, November 21. It is situated at Acklington on the Northumbrian coast and will be known as No. 2 Air Observers' School. Acklington was opened this year as No. 7 Armament Training Station. The creation of this school has been made necessary by the increase in the number of air observers called for under the recent expansion scheme.

Acklington will be a "sister school" to No. 1 Air Observers' School at North Coates, near Grimsby, Lincolnshire. Both are capable of dealing with 60 air observers at a time and a six weeks' course of training in gunnery and bombing is set. Acklington's air firing and bombing ranges are situated on the shore of Druridge Bay.

The air observers are drawn from among aircraftmen by selection and directly from civil life. Before being posted to Acklington or North Coates they complete a three months' navigational course at a civil flying school and two weeks' routine training at a Service depot. There are vacancies as air observers for men, of a good standard of education, between the ages of 18½ and 25 years. Acklington will receive air observers from the navigational schools at Desford, near Leicester, and Ansty, near Coventry. North Coates completes the training of air observers from the civil schools at Prestwick, Ayrshire, and Yatesbury, near Calne, Wiltshire.

The Hendon Auxiliaries

AIR VICE-MARSHAL GOSSAGE, A.O.C., No. 11 (Fighter) Group, inspected Nos. 600, 601 and 604 (Fighter) Squadrons at Hendon on November 20. He complimented them all on their behaviour in the recent crisis when the fighter squadrons of the A.A.F. were mobilised. He referred to the recent re-equipment of No. 601 (County of London) Squadron with Gauntlets, and said that he hoped all A.A.F. fighter squadrons would soon be supplied with still better and faster machines.

This was the first inspection on which these squadrons appeared with their machines camouflaged.

Royal Air Force Gazette

General Duties Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated: E. R. Bitmead (September 16); J. S. O'Brien (Acting Flight Lieutenant) (October 16); D. O. Finlay (October 30); S. G. Pritchard (November 3).

Sqn. Ldr. J. Heber Percy ceases to be seconded for service as Aide-de-Camp to his Majesty's Ambassador in Cairo (October 12); Lt. N. McI. Kemp, R.N., Flight Lieutenant R.A.F., ceases to be attached to the Royal Air Force on return to Naval duty (October 11); Flt. Lt. F. E. H. Cooper is transferred to the Reserve, class A (November 1).

Chaplains Branch

The Rev. T. M. Lawrence is granted a short-service commission with the relative rank of Squadron Leader (November 3).

Memorandum

The permission granted to W. H. Bland to retain the rank of Second Lieutenant is withdrawn (October 11).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The following Squadron Leaders are granted commissions as Flight Lieutenants: Honorary Squadron Leaders in class CC with effect from May 7, and with seniority of the dates stated: R. S. Barbour (Honorary Squadron Leader, November 5, 1937) (December 16, 1935); G. R. Hicks, D.F.C. (Honorary Squadron Leader, March 2) (July 10, 1936); F. Thomasson, D.F.C., M.M. (Honorary Squadron Leader, November 5, 1937) (December 7, 1936); F. J. Taylor (March 1).

The following are granted commissions in class CC in the ranks stated with effect from May 7 and with seniority of the dates stated:—Flight Lieutenants: E. A. Sullock, A.F.C. (October 1, 1935); R. E. Barrett (November 9, 1935); R. J. Read (February 3, 1936); A. J. Nightingale (February 14, 1936); L. H. Brooke (June 15, 1936); W. G. Nicholls (July 1, 1936); C. N. C. Dickson, A.F.C. (November 9, 1936); H. Bligh (January 4, 1937); E. S. Osborn (January 13, 1937); C. H. Glover (May 7, 1937); R. Macfarlan (May 10, 1937); E. M. Morris (August 15, 1937); N. T. Goodwin (September 20, 1937); R. E. Hall (October 6, 1937); G. V. T. Thomson (December 23, 1937); H. E. Sales (March 3); H. C. Todd (April 1).

The following Flying Officers (Honorary Flight Lieutenants) relinquish their honorary rank and are granted commissions in class CC as Flying Officers with the acting rank of Flight Lieutenant with effect from May 7 and with seniority of the dates stated: W. H. E. Tew (December 20, 1935); N. W. Wale (January 1, 1936); K. W. Pell (March 9, 1936); C. J. Farrell (March 30, 1936); E. C. Durbin (April 1, 1936); J. W. C. Glen (September 2, 1936); C. B. Dove (December 10, 1936); M. J. Wyatt, M.C. (June 1, 1937); W. R. A. Matheson (September 13, 1937); A. L. Brain (November 10, 1937); H. J. Forster (December 10, 1937); L. G. Rumsey (April 1); T. R. Wheatley (April 11); C. H. Williams (May 2).

F/O. (Honorary Flight Lieutenant) F. T. Eades, D.F.C., is granted the rank of Flight Lieutenant (August 5); Flt. Lt. R. S. Higgens is transferred from class A to class C (October 15).

The following are transferred from class C to class CC (May 7):—Wing Commander: H. Dawes, M.B.E. Squadron Leaders: B. E. Harrison, A.F.C., J. B. Bowen, C.B.E. (Honorary Air Commodore). Flight Lieutenants: A. E. Dark, B. D. S. Tuke, J. E. Preston, A. M. Webster, J. W. Griffith, B. C. Moody, M.B.E., F. T. McElwee, G. I. C. Peacocke, R. J. Copley, H. G. P. Ovenden, A. J. P. Groom, D. G. Fleming, E. Drudge, M.B.E., J. Everidge, M.C. (Honorary Squadron Leader), J. H. Truscott, J. S. Holloway, C. D. Pyne, J. W. Caddy, H. H. S. Scott, D.S.M., R. Jones, D. G. Singleton, A. V. Taylor, H. G. Spearpoint, A. Lees, R. S. Hellier, D.F.C., F. V. Gauntlett, W. L. Shaw, M.B.E. (Honorary Squadron Leader), A. F. Ingram, F. B. Young, A. H. Goldie, H. P. S. Clogstoun, M.B.E., G. E. Pyne, W. E. Reason (Honorary Squadron Leader), S. C. Black, M.M., F. E. Bishop, M.B.E., N. H. Dimmock, A.F.C., E. J. Moule, H. E. F. Saunders, J. G. Argles, J. Kemper, M.B.E. (Honorary Squadron Leader), W. A. C. Heyman, T. F. G. Strubell (Honorary Squadron Leader), R. Stiven, W. R. Castings, M.B.E., H. R. Kavanagh, M.B.E., E. L. P. Morgan (Honorary Squadron Leader), A. L. Cockburn, J. H. Leach, G. M. F. O'Brien, D.S.C., R. F. de R. Read, O. C. Cassels, D.F.C., C. J. Elliott, H. A. Boniface, S. H. Reynolds, M. G. Bircham, A. B. Smith, M.C., H. T. O. Windsor, M.C., W. B. Hellard, D. R. Sharman, M.C., K. D. Abercromby (Honorary Squadron Leader), J. F. Shooter, G. A. Wells, M.C., C. A. Gregory, J. P. Cafferkey, F. Pyle, J. Selwyn, J. H. Page, B. B. Dowling, J. E. M. Atherley, E. Gillespie, D.S.O., H. C. Tallboy, J. E. Parkin, M.B.E. (Honorary Wing Commander), J. C. Mitchell, W. W. Hart, M.B.E. (Honorary Squadron Leader), H. H. Maund, S. H. Woolf, R. F. C. Metcalfe, G. F. M. Warner, R. W. G. West, A. W. H. Nelson, L. J. Fox, L. S. Weedon, G. J. Watney, O.B.E. (Honorary Squadron Leader), G. E. Gordon-Duff, T. K. Burton, W. H. Day, L. H. Cooper, I. B. Beesley, H. A. Anson, A. H. Dalton, W. Coker, D.F.C., C. M. Crowe, M.C., D.F.C. (Honorary Squadron Leader), R. C. Savery, D.F.C., W. T. Clyde, B. Hodson, M.B.E., T. G. Hungerford, T. H. R. Riggs, D.C.M., M.M., H. J. Eastwood, M.C., A. R. Smeathers, C. M. Lister, M.C., H. A. C. Atkinson, E. W. Reynolds, A. G. D. Alderson, A. R. Hughes, M.B.E., J. J. Westmoreland, S. A. D. Lane, H. J. Wykes, H. C. Pyper, V. R. S. White, M.C., H. E. Greenberry, W. L. Whitlock, B. S. Brice, A.F.C., I. Cullen, M.B.E., A.F.C. (Honorary Squadron Leader), W. A. Lindsay-Watson, L. M. S. Essell, R. P. Smillie, H. A. S. Byrne, S. L. Delahay, J. C. Brice, T. R. Wells, M.C., E. A. Roberts, J. F. Clark. Flying Officers.—E. W. Barry, L. R. Butters, E. A. Burton, D. M. B. Fitzgerald-Lombard, K. M. Lloyd-Jones, J. D. Loughnan, H. L. Rudd, J. Collier, D.F.C. (Honorary Flight Lieutenant), E. H. Roberts, J. S. Curtis (Honorary Flight Lieutenant), A. T. C. Cooper, I. N. Macmillan, H. A. Sawyer, M.C., A. Rowan (Honorary Squadron Leader), H. W. Guy (Honorary Flight Lieutenant), N. McLeod, F. T. Eades, D.F.C. (Honorary Flight Lieutenant), R. M. Waddington (Honorary Flight Lieutenant), G. E. D. Low, C. L. Hudson, H. J. Crampton, C. N. McLoughlin, L. A. Jessop, D.F.C.

S. J. Gilbert is granted a commission as Flight Lieutenant in Class C (April 9).

Equipment Branch

Flt. Lt. R. Bassett is granted a commission in Class CC in that rank with effect from May 7 and with seniority of March 5, 1936; Flt. Lt. A. J. Nightingale is transferred to the General Duties Branch, Class C (November 1).

The following are transferred from Class C to Class CC (May 7):—Flight Lieutenants.—W. H. Anderson, L. N. Sargent, W. B. J. Humphrey.

Auxiliary Service

General Duties Branch

No. 601 (COUNTY OF LONDON) (FIGHTER) SQUADRON.—F/O. P. R. Foley is promoted to the rank of Flight Lieutenant (August 25).

Owing to the greatly increased length of these lists, as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above.

SOMETHING NEW in UNDERCARRIAGES

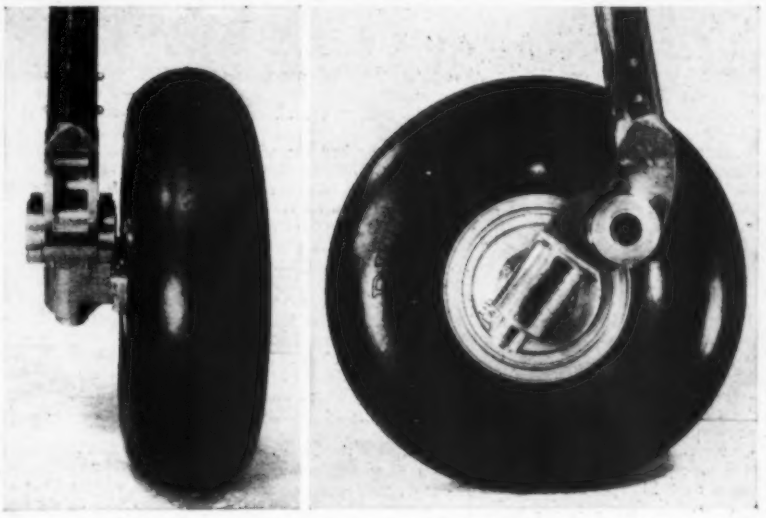
The La est Dowty Aircraft Wheel : Built-in Oleo-Pneumatic Shock-Absorber

PROMINENT among the claims made for a new and outstandingly interesting Dowty aircraft wheel is the possibility of standardisation. The new wheel, with intermediate-pressure tyre, can be supplied complete with brakes and built-in oleo-pneumatic shock-absorber.

Four designs are available covering all sizes of aircraft weighing between 6,000 and 24,000 lb. Each size of wheel hub can be provided with a standard brake and shock-absorber to accommodate different weights, and characteristics of the springing mechanism can readily be varied by adjusting the vertical wheel travel and changing the shock-absorber inflation pressure.

The manufacturers—Aircraft Components, Ltd., of Cheltenham—claim that the standardisation makes for extremely rapid production, and that it will result in much lower costs.

The new wheel is a direct development of the high-pressure



Two views of the new Dowty wheel, with built-in oleo-pneumatic shock-absorber and cantilever mounting on a single strut.

Flight testing was carried out on a D.H. 89. The "L" shaped fittings carrying the wheel arms were used to preserve the present location of wheel and vertical struts. Such fittings will not normally be required.

internally-sprung Dowty wheel which is fitted as standard equipment on the Gloster Gladiator fighter and the Westland Lysander army co-operation machine.

As already mentioned, the new springing is oleo-pneumatic. Impact loads are no longer dissipated by the conventional telescopic type of shock absorber strut, but by a pin-jointed oleo-pneumatic shock-absorber free from bending and racking loads. Another advantage claimed for the new type of springing is that a wheel travel as great as 18in. can be provided, opening up new possibilities in the development of tricycle undercarriages.

Wheels of the new type can be cantilevered from a simple rigid strut. The undercarriage structure is rigid, with the exception of the short arm to which the wheel is attached, so retraction is in no way affected and the geometry is, in fact, simplified. In combination with the Dowty "nutcracker" undercarriage arrangement, complete standardisation can be effected.

Successful flight tests with these new wheels have already been made under Air Ministry supervision at Farnborough and independent tests on various machines have also been conducted.

According to the manufacturers, it has been found that smoother taxying and more pleasant take-off and landing characteristics are obtainable and it has also been noticed that there is a complete lack of mechanical noise. The smoothness of operation makes for reduction in maintenance and overhaul costs.

Research into the future possibilities has revealed that size imposes no limitation on the design of wheels of this type for even the largest landplanes at present under construction. Wheels have been planned for aircraft weights of 68,000 lb. and, at the other end of the scale, have been successfully used on machines having a wheel load of less than 1,000 lb. Finally, it is claimed that substantial weight savings can be effected.

Particulars of this new springing system will be available on Stand 4, Balcony Z, at the Paris Show.

Royal Trainer

KING GHAZI OF IRAQ, who is an enthusiastic aircraft owner, has just taken delivery of a Miles Magister from Phillips and Powis, Ltd. Like those supplied to the R.A.F., it has a blind-flying hood, aerobatic harness, and all necessary training instruments.

How a "750 Hours" Gipsy Six Stripped

LAST week we reported that official approval had been given to the extension of the Gipsy Six I overhaul period from 600 hours to 750 hours. Following the usual practice the concession was officially made after a number of engines—twelve in this instance—had been permitted to run to the extended period in the hands of commercial operators working under well-varied conditions.

One of these trials was made with Olley Air Service, Ltd., and the engine subsequently stripped by Rollasons, Ltd. The report on the stripped unit, prepared by the D.H. engine inspection department, is given a facsimile reproduction in the November issue of *The De Havilland Gazette*, and makes interesting and convincing reading. Photographs of the pistons and other components testify to the part played by the oil—AeroShell—in achieving the ultimate success.

Incidentally, last week's paragraph contained a slip; the mileage flown in 750 hours should obviously have read "100 000."

THE INDUSTRY

Tools from A to Z

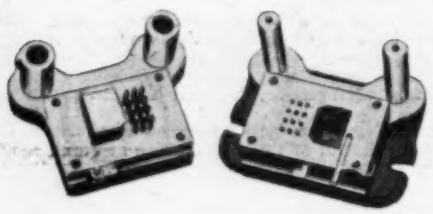
THERE is the old conundrum that asks, "Which came first—the hen or the egg?" The innocent visitor to a toolmakers' factory likewise feels impelled to ask, "Which came first—the tool-maker or the tool?"

Such curiosity becomes particularly intense when the visitor is looking round the works of that very old-established Sheffield firm of toolmakers, Henry Rossell and Co., Ltd., for here almost every type of tool and jig is made, as well as the tools used in their manufacture. In fact, this company is almost entirely self-sufficient, for the works can deal with nearly all the problems connected with steel, including melting and correct manipulation.

The visitor finds this factory a rather fascinating mixture of old and new. Pride of place must be given to the new specialised tool shop, laid out on the most modern lines and equipped with some of the finest machinery obtainable in the world. All machines are fed from services installed beneath the special maple-wood floor. In a separate bay is a Genevoise 5B jig borer mounted on its own concrete bed, and nearby is a Hauser jig borer.

Other plant in this shop includes a Studer profile grinder, a Keller 2416 die sinker, Thiel punch shapers and millers, Brown and Sharpe universal and omniversal millers and a Cincinnatti-Bickford radial driller.

The work of this section is supplemented by a new heat-treatment department in which the furnaces are atmosphere-,



A typical blank and pierce tool by Henry Rossell and Co., Ltd.

temperature- and time-controlled by an ingenious master control. An electric pyrometer control records the heat-treatment undergone by each batch of tools.

Henry Rossell and Co. specialise in the manufacture of nearly every type of twist drill, lathe tool, cutter and file. For the most part the drills are cut and ground on automatics, but the actual finishing and trimming processes are dealt with manually by craftsmen. Incidentally, the drills manufactured here range from the smallest to sizes up to three inches in diameter. Certain lathe tools are cut and shaped to extraordinarily fine limits with the aid of a Zeiss tool-maker's microscope which enables accurate measurements to be taken down to 0.0001in. and one minute of a circle; it is also possible to split the minute visually into quarters. This old-established company—the Victory Blue Riband trade mark was first granted in 1845—supplies nearly all the leading aircraft companies with jigs, press tools, drop-forging dies and all types of small tools. Reamers, flat-ground stock, shear blades, tool and crucible steels, machine knives, formed rolls and centreless, stainless and alloy steel bar ground to an accuracy of plus or minus 0.00025 in. are just a few of the Rossell lines.

At their Waverley Works, Henry Rossell and Co. are able to undertake, with Air Ministry approval, the manufacture of all the tools mentioned, together with the melting and manipulation of steel. Incidentally, the work is under the management of men who have more than a nodding acquaintance with aviation; Mr. K. Shenstone, the managing director, flew to Australia in a heavily overloaded Gipsy I Moth as passenger with the late P. G. Fairbairn. The chairman is Mr. F. W. Shenstone, and Mr. H. Shenstone is a director.

The Barnet Boost Gauge

READERS will recall the description, in *Flight* of November 10, of the boost gauge made by Barnet Instruments, Ltd. The makers emphasise that the triple-Bourdon-tube arrangement, which is the chief feature of the instrument, is the subject of complete Patent No. 482464, while the method of draining away fuel condensate is provisionally protected.

Captain J. S. Irving

THE many friends of Capt. Irving, of Bendix, Ltd., will be sorry to hear that he is having to undergo an operation, though they will be relieved to know that it is not of too serious a nature. He hopes to be out and about again somewhere round the middle of December.

Death of a Pioneer

FLIGHT greatly regrets to record the death in London last Saturday of Mr. Eric Platford, of the technical staff of Rolls-Royce. "E. P" joined the firm before it moved to Derby in 1907, and from the war period until two years ago was in charge of both car and aero engine testing. When the department grew too large for one man to manage he remained head of the aero engine section. Mr. Platford had come up to London for an Air Ministry conference, and his death was most sudden and unexpected.

Big Bristol Capital Increase

AT an extraordinary general meeting to be held at Filton on November 29, proposals will be made to increase the capital of the Bristol Aeroplane Co., Ltd., from £1,800,000 to £3,900,000 by the creation of 4,200,000 new Ordinary shares of 10s. each, and also to capitalise £900,000 (part of the sum of £1,200,000 now standing at the credit of reserve) and apply it in paying up in full 1,800,000 new Ordinary shares to be distributed to the holders of Ordinary shares on the register on November 19, 1938, in the proportion of three new shares for every four shares held.

An interim dividend of 7½ per cent., subject to tax deduction, was declared last week.

A Cricklewood Year

AT the twenty-fourth ordinary general meeting of S. Smith and Sons (Motor Accessories), Ltd., the chairman, Mr. Walter Henderson-Cleland, spoke of the marked progress which their instrument section—Smith's Aircraft Instruments—had made during the past year. New instruments had been put into production and delivered in considerable numbers. New instruments were being designed and would shortly be manufactured.

Arrangements were made during the year for the exchange of manufacturing rights upon a reciprocal basis with a leading firm of instrument makers in America, and a number of instruments had been produced here as a result of this agreement.

The company's automatic pilot had been adopted by the French Air Force as standard equipment for their various aircraft. Negotiations were in hand with several other foreign Governments. A contract to supply automatic pilots to Air France had also been secured, while orders had been received from Imperial Airways.

Henry Hughes and Son, Ltd., which had now been completely reorganised, showed a satisfactory result. Additions to the plant had resulted in an increased turnover of their products, which included echo depth sounders, compasses, sextants, and other aeronautical and marine instruments.

Mr. Henderson-Cleland also spoke of the progress made by another associated company, the K.L.G. Sparking Plug Co., and recalled the notable successes by aircraft fitted with their products; these include the capture of the long-distance record by the Wellesleys and first three places in the King's Cup Race.

Mr. A. Gordon Smith (managing director) said that the aircraft side presented the greatest problems for their engineers to solve, as the development of faster and larger aircraft, flying at altitudes hitherto considered impossible, called for a new range of instruments to meet these altered conditions, while they had to consider not only the requirements for present-day aircraft, but for those likely to be produced in 1939, 1940, and so on.

The actual designing of these instruments required first-rate engineers, and once the instruments were designed they met the difficulty of obtaining enough highly skilled young engineers and instrument makers to manufacture and assemble these articles of great precision.

Last year he informed the shareholders that the company was establishing a technical school for the purpose of training these young men. He was glad to say that they had now established this school and were commencing the training of their own young people.

THE AIRCRAFT ENGINEER

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AERONAUTICAL RESEARCH

Dr. Seewald Describes the Work of the DVL

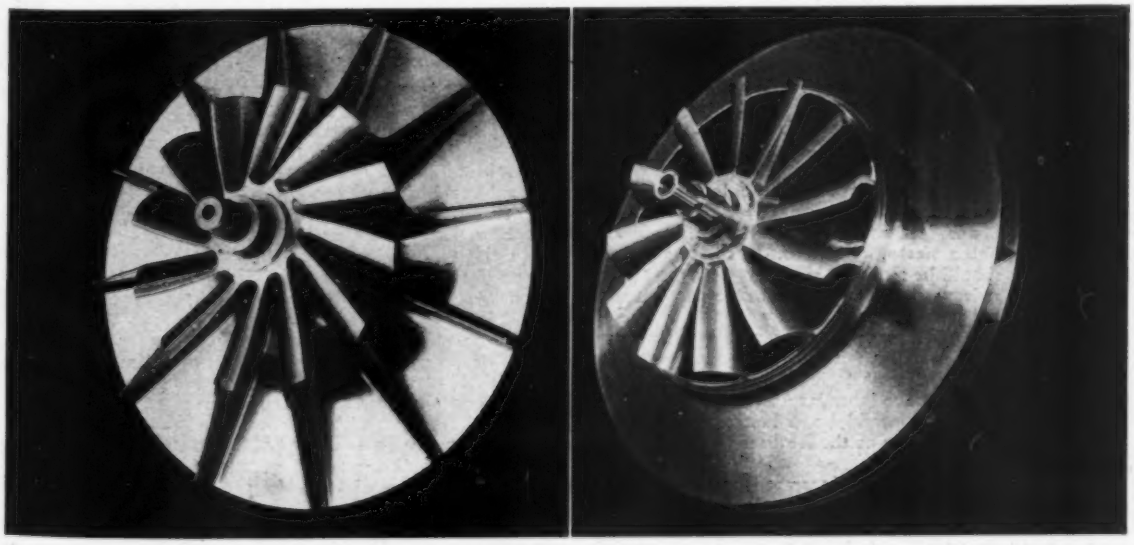
THE Royal Aircraft Establishment and the National Physical Laboratory rolled into one might, perhaps, be used as an explanation of the functions of the Deutsche Versuchanstalt für Luftfahrt, abbreviated, if one is in a hurry, to DVL. And yet that picture would not be an entirely correct one. The exact position was explained very clearly by Dr. F. Seewald, the leader of the DVL, in his lecture to the R.Ae.S. last Thursday, when he described the basis and work of the DVL.

As the central scientific aeronautical institute, the DVL extends its activities to every branch of aerotechnical development, physical and engineering science. Most other aeronautical institutes in Germany are attached to universities, and usually specialise on some particular aspect. The work of the institute can be divided into two main classes: investigation of numerous practical problems, usually undertaken on behalf of the German Air Ministry, firms in the German aircraft industry and the Deutsche Lufthansa operating company; and general scientific research into fundamental problems. The former is paid for by the firms concerned, while the German Air Ministry pays for the latter or *ad hoc* research. The lecturer explained that the DVL formerly undertook the issue of certificates of airworthiness and the testing of materials specimens, but that when the Air Ministry was founded five years ago that work was transferred to a separate department.

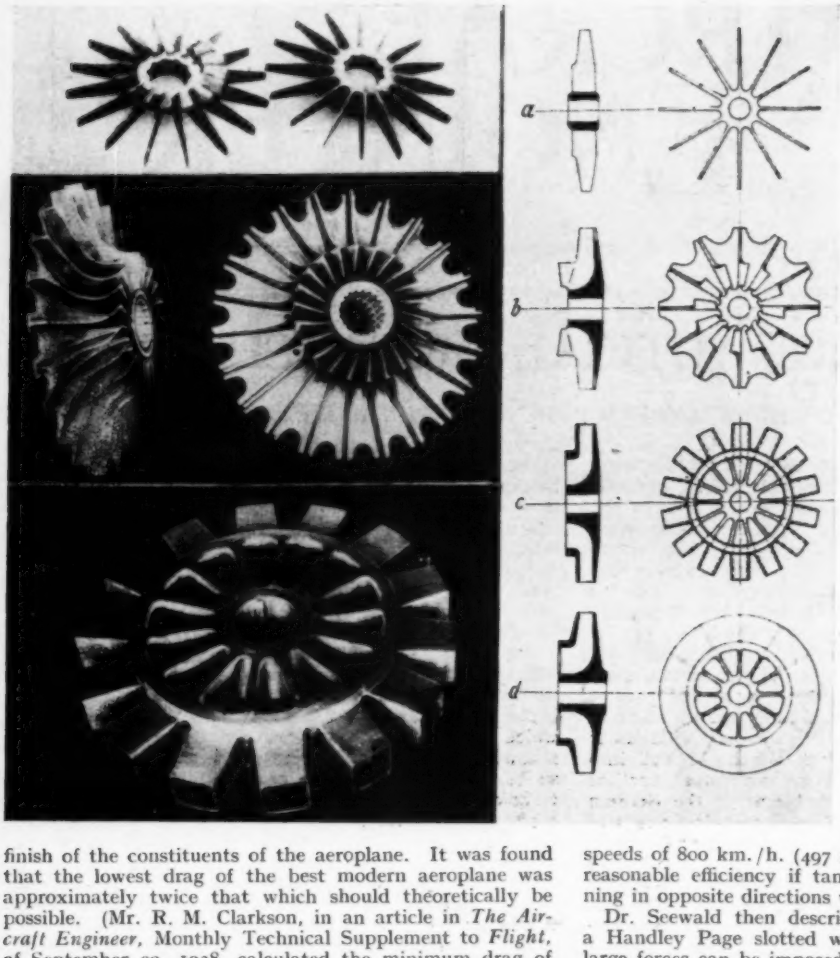
Dr. Seewald had the sympathy of his audience when he explained that for obvious reasons he would not be able to deal with that portion of the work of the DVL which related to specific research for firms, and which was undertaken by the institute on behalf of them, rather in the role of consulting engineers. He would confine himself to fundamental research, in the selection of which the DVL had the assistance of the experts of the Lilienthal Gesellschaft.

The guiding principle was to carry out investigations which would enable them to recognise as early as possible the probable trend of future development and the problems likely to arise from it. As examples of the questions which they asked themselves, Dr. Seewald quoted the following: The speed required and attained; the altitude to be reached; dimensions of aircraft and engines; the technical problems to be solved in order to attain these performances successfully. The research establishment which could give an answer to these questions would be in a fair way towards solving the problems.

On the subject of minimum attainable drag the lecturer recalled the work of Professor B. Melvill Jones, of Cambridge, and explained briefly the system of taking the sum of the drags of known "best" wings and fuselages, etc., as the minimum, the degree to which the real aeroplane fell short of this figure being then a measure of the interference drag and of the imperfections in shape and



Two DVL rotors with rotating guide vanes. Left, the half-open type and right, the rotor enclosed on both sides.



Types of rotor investigated by the DVL. The plain, open type is shown in *a*, and the shrouded type with one disc in *b*, while *c* is a ducted type. The shrouded type of rotor, with two discs, specially developed by the DVL, is shown in *d*.

finish of the constituents of the aeroplane. It was found that the lowest drag of the best modern aeroplane was approximately twice that which should theoretically be possible. (Mr. R. M. Clarkson, in an article in *The Aircraft Engineer*, Monthly Technical Supplement to *Flight*, of September 29, 1938, calculated the minimum drag of the D.H. Albatross and found that what we may term the drag due to necessary evils was only 46 per cent. of the total drag.—ED.)

In order to determine the best approximation to the ideal drag which might be obtained with a practicable aircraft a comparison was carried out at the DVL with two models constructed with special care in all details. The result was a minimum drag 1.3 times the ideal minimum instead of twice, so that it appeared that there was justification for hoping that the drag of fast aircraft could be reduced in the ratio 2/1.3, *viz.*, by 30 per cent. This would mean an increase in speed of about ten per cent.

As was, perhaps, to be expected, the lecturer stated that it had been found that the drag of radiators and engine nacelles was farthest removed from that ideally attainable. These items, therefore, merited particular attention. It should be realised, however, that during the last ten years a large percentage of possible aerodynamic improvement had been attained.

Barring some new discovery, only step-by-step improvement seemed possible. Such a new discovery would be made if it became possible so to influence the airflow over wings and fuselage that the boundary layer did not become turbulent. The result would be reduced drag. That, rather unkindly, was as far as the lecturer went along that particular line of research.

Wing loading as an aid to increased speed was dealt with next. The lecturer took an aeroplane with a power loading of 0.2 h.p. per kg. weight (or according to our way of expressing it, 11lb./hp.) flying at a height of 4 km. (13,000ft.) and examined the effect of reducing the wing area, keeping aspect ratio constant at a value of 8. He came to the conclusion that up to a wing loading of 200 kg./m² (41lb./sq. ft.) there was a gradually diminishing gain in speed. Above that wing loading the gain became very small and an increase beyond 200 kg./m² seemed hardly worth while. At heights greater than 13,000ft. there was little gain in exceeding a wing loading of 41lb./sq. ft.

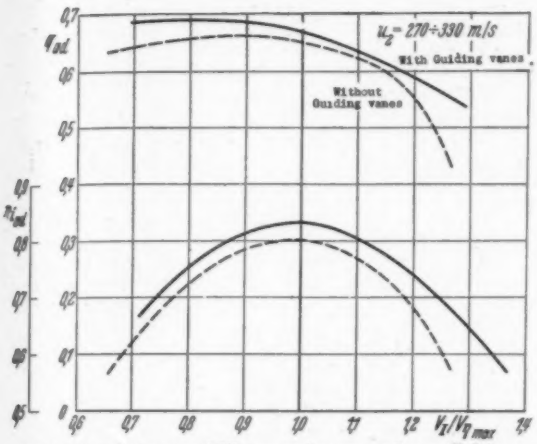
Considerations of airscrew efficiency related to tip speeds nearing the speed of sound led to the conclusion that up to speeds of about 550 km./h. (341 m.p.h.) there should be an increase in efficiency with airscrews of normal proportions running at normal speeds, and that beyond this forward speed the efficiency drops off, the decrease being rapid beyond 700 km./h. (435 m.p.h.). This drop was largely due to energy loss in the rotating slipstream, and speeds of 800 km./h. (497 m.p.h.) might be possible with reasonable efficiency if tandem concentric airscrews running in opposite directions were used.

Dr. Seewald then described some interesting tests on a Handley Page slotted wing, which showed that very large forces can be imposed upon the slat and wing when the aeroplane is pulled sharply out of a dive. This is caused by the fact that the airflow does not break away instantly when the angle of incidence is changed suddenly, and there is thus momentarily a very high lift. Forces of twice the value reached in the wind tunnel were measured.

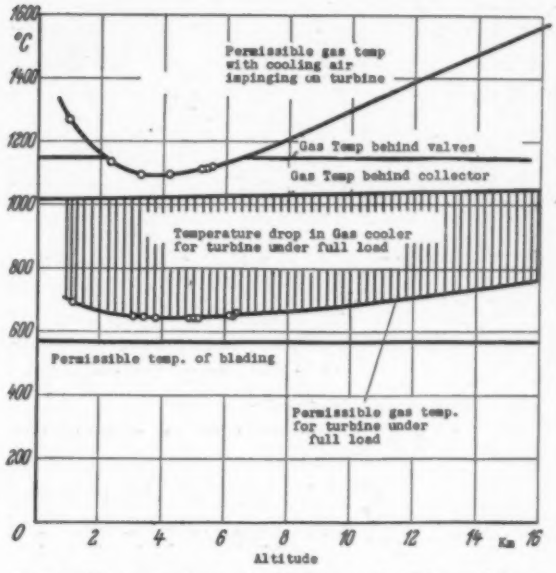
Route Stress Records

Results of a long series of stress measurements were also given. These were recorded over a long period on commercial aircraft in regular service on the air routes, the records showing how often a definite stress occurred as a result of gusts, banking and flattening-out in 100 flying hours. The sequence of the loads was found to be important. The number of cycles of alternating loads which a structural member would support was lowest when the highest load was applied at the beginning and then reduced to a minimum. The member showed a better resistance if the maximum and minimum loads alternated in definite cycles.

Most interesting was Dr. Seewald when he turned his attention to the question of aero engine research, and more particularly research on superchargers. The DVL began its work on altitude engines in the altitude chamber in 1936. Since that time, during a working period of 2,000 hours, the behaviour at altitude of five liquid-cooled and five air-cooled engines had been investigated. The data obtained proved valuable as a basis for development of superchargers and exhaust-driven turbines. The lecturer stated that as a result of this work, although much remained to be done, they were past the stage of groping blindly for knowledge of engine behaviour at altitude.



Efficiencies of the new DVL supercharger and a radial type with outlet guide vanes and spiral casing (full lines). The dotted lines represent radial superchargers without guide vanes but with a spiral casing. The DVL supercharger is designed for a height of 15,000ft. and a pressure of 1.35 atmospheres; power 1,200 b.h.p. and peripheral speeds ranging from 885 to 1,083ft. per sec., corresponding to adiabatic altitudes of 16,000 to 25,000ft.

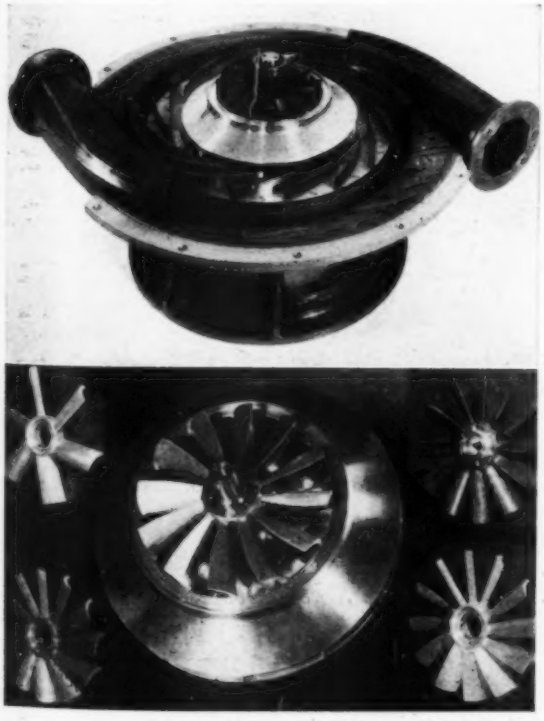

°C
Permissible gas temp with cooling air impinging on turbine
Gas Temp behind valves
Gas Temp behind collector
Temperature drop in Gas cooler for turbine under full load
Permissible temp. of blading
Permissible gas temp. for turbine under full load
Altitude
Km

Permissible temperatures of exhaust gases for exhaust-driven turbines.

In developing superchargers three main objects were kept in view: to obtain the highest possible density of the compressed air; to retain as low a temperature as possible; and to be able to control the external dimensions so that the supercharger would fit into the installation.

The investigations undertaken included shaping of the air inlet, the rotating guide vanes, the rotor drive, the number of impeller blades, the number and shape of the stationary guide vanes, and the spiral casing.

Many superchargers were tested, four of the types being shown in illustrations. The graph shows the results obtained with the supercharger developed by the DVL. Another illustration shows the supercharger used for test purposes. An interesting feature of this was that the spiral casing was made of wood so as to make changes in shape fairly easy to carry out.

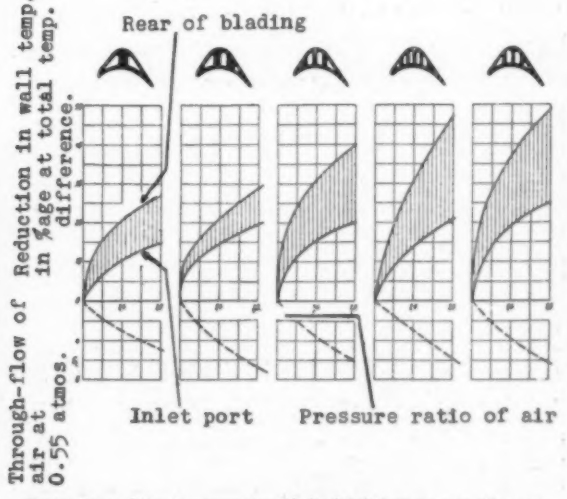


The test supercharger used by the DVL has variable guide vanes, a wooden spiral casing, DVL rotor with interchangeable blades for the rotating guide vanes.

Ground Level to 33,000ft.

Dr. Seewald stated that as a result of these tests it was possible to say that ground-level pressure could be maintained up to a height of 10 km. (33,000ft.) with single-stage blowers and without having to arrange for cooling the compressed air before passing it to the engine.

For greater rated heights than were used at the present time, particularly when coupled with long range, the exhaust-driven supercharger would be worth while. The difficulties were connected with the high temperatures in which the turbo blades had to work, and the lecturer gave particulars of work on developing materials capable of


Rear of blading
Through-flow of air at 0.55 atmos.
Reduction in wall temp. in %age at total temp. difference.
Inlet port
Pressure ratio of air

Reduction of the temperature of the blades as a percentage of the total temperature-difference between the mean cooling air temperature and the boundary layer of the gas, at full impact, for various sections.

retaining their mechanical qualities in temperatures of over 580 deg. C. Although great progress had been made, the strength values obtained were not quite sufficient.

The efficiency of a turbine was produced either at high temperature and low pressure-drop, or conversely by low temperature and high pressure-drop. The best prospects seemed to lie with the constant-pressure exhaust method, and this meant keeping the pressure in front of the turbine as low as possible and putting up with the highest possible exhaust gas temperatures.

Cooling Problems

If it was assumed that the highest permissible temperature for the blades to work in was 570 deg. C., the permissible temperature of the gas in front of the turbine would be 650 deg. C., increasing with altitude to 800 deg. C. This would require a temperature-drop of 350 to 500 deg. in the temperature of the gas behind the exhaust valve.

Two possible methods of cooling the gas presented themselves: by mixing the gas with air and by surface cooling. The latter seemed to be the better, thermodynamically, but presented difficulties due to the extra weight and drag.

Instead of trying to cool the gas, there was the possibility of cooling the blades. Two methods had been investigated by the DVL. In the first the cooling was obtained by exposing portions of the blades to the slip-stream; in the second the blades were hollow and cooled by the air flowing through them. Dr. Seewald expressed the view that by combining the two methods it might be possible to attain a cooling efficiency sufficiently great to avoid the need for cooling the gases.

Referring to investigations into problems of knocking, Dr. Seewald made the interesting statement that the suggestion made by our own Mr. Ricardo long ago, that the sleeve-valve engine should give greater freedom from knocking and so make possible the use of higher compression ratios, had been confirmed at the DVL.

As a result of investigations of special long-range power units, the lecturer concluded that the two-stroke diesel promised well for flight at medium heights, while for really great heights the electric ignition engine specially developed for fuel economy, and the four-stroke diesel, both with turbo superchargers, might give better results.

AERONAUTICAL PATENT SPECIFICATIONS

(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

(*Published October* 27, 1938).

9119. BOULET, G.: Engine-cooling systems for vehicles and aircraft (492,904).
9308. BRISTOL AEROPLANE CO., LTD., and FRISE, L. G.: Gun-turrets for aircraft (493,115).
9799. CIERVA AUTOGIRO CO., LTD., and BENNETT, J. A. J.: Aircraft with sustaining rotors (492,816).
9801. CIERVA AUTOGIRO CO., LTD., and BENNETT, J. A. J.: Sustaining rotors for aircraft (492,911).
9825. JUNKERS FLUGZEUG-UND-MOTORENWERKE AKT.-GES.: Extinguishing of burning light metals (492,971).
14463. CLARK, D. R., and BIRD, W.: Device for automatically opening parachutes (492,777).
18420. BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.: Vehicle suspension systems (492,841).
20208. KLEMM, H.: Construction of aircraft and other vehicle bodies, containers or other light hollow bodies (492,796).
837. WATTS, H. C., and AIRSCREW CO. LTD.: Construction of rotary fans and the like (492,801).
866. DAIMLER-BENZ AKT.-GES.: Fuel control of internal-combustion engines (492,857).
10730. TELEFUNKEN GES. FÜR DRAHTLOSE TELEGRAPHIE: Direction-finding radio receiver systems (493,027).
11364. JUNKERS FLUGZEUG-UND-MOTORENWERKE AKT.-GES.: Suspension of vehicle bodies (492,881).
12887. THIEMANN, W. H. A. (Vereinigte Deutsche Metallwerke Akt.-Ges.): Pitch angle indicator device for variable-pitch propellers (493,032).
16130. HUTH, F.: Screw propellers for aircraft, and the method of reinforcing the leading edges of the blades thereof (492,804).

(*Published November* 3, 1938).

6499. BAYNES L. E.: Aircraft (493,439).
9219. JABLONSKY, B.: Pressed articles, particularly airscrew blades of laminated wood and method of manufacturing the same (493,145).
9800. CIERVA AUTOGIRO CO., LTD., and BENNETT, J. A. J.: Aircraft with rotors (493,149).
10221. NASH, A. G. FRASER: Machine guns (493,468).
10255. TURNERS MOTOR MANUFACTURING CO., LTD., and MILNER, H. C.: Extendible and contractible strut or jack for aerial machines (493,471).
10296. AUTOMOTIVE PRODUCTS CO., LTD., and GATES, G. R. G.: Ball-and-socket and like universal joints (493,472).
11248. BICKEL, E.: Anti-aircraft projectiles (493,313).
14336. GETEFO, GES. FÜR TECHNISCHEN FORTSCHRITT: Resilient mounting of motors for vehicles and aircraft (493,328).
17295. WHITEHEAD TORPEDO CO., LTD., and JONES, LTD.: Gyroscopic steering-apparatus for torpedoes and the like (493,226).
21753. SHORT BROS. (ROCHESTER AND BEDFORD), LTD., and PARKS, A. G.: Elastic door seal (493,163).
22805. FAIREY AVIATION CO., LTD., and YOUNGMAN, R. T.: Flaps for aerofoils (493,391).
24634. TELEFUNKEN GES. FÜR DRAHTLOSE TELEGRAPHIE: Direction finding or homing systems (493,393).
29752. MERCIER, G. E. P. and PERROT, L. R. C. G.: Aircraft (493,178).
31758. BURTENBACH, H. F. S. VON: Hydroplanes (493,176).
34255. SPERRY GYROSCOPE CO., INC: Remote control systems (493,408).
1361. ENGLESSON, J. E.: Operating devices for propellers, turbine wheels, and pump wheels having screw blades adjustable for pitch (493,416).
3142. DORNIER-WERKE GES., and DORNIER, C.: Metal air-propellers (493,255).
3571. DAIMLER-BENZ AKT.-GES.: Fuel supply means for internal-combustion engines using alternatively a carburetter or gas from a generator (493,421).
8349. ARADO FLUGZEUGWERKE GES.: Device for controlling the gliding angle in aircraft (493,427).
8562. BRITISH TIMKEN, LTD., and HILL, A. W.: Appliances for forcing bearing members upon shafts or axles and/or for removing the same therefrom (493,498).
10858. LORENZ AKT.-GES., C.: Two-way directive wireless system (493,429).
13560. JUNKERS FLUGZEUG-UND-MOTORENWERKE AKT.-GES: Mounting of window panes in the cabins of aircraft (493,503).
13843. ZAVODY RINGHOFFER-TATRA AKCIOVA SPOLECNOST: Air-cooling of internal combustion engines (493,431).

(*Published November* 10, 1938.)

7387. BACK, W. E.: Aircraft (493,762).
10244. GALLAY, H. M.: Control of aircraft (493,709).
10455. LINDE AIR PRODUCTS CO.: Method and apparatus for cutting and heat-treating metal (493,772).
10842. LINDE AIR PRODUCTS CO.: Electric welding (493,866).
10932. HUTH, F.: Aircraft structure (493,627).
11010. BENDIX AVIATION CORPORATION: Magneto rotors (493,877).
16569. HORROCKS, W. A.: Mounting of aircraft engines (493,651).
17136. DUNLOP RUBBER CO., LTD., BEHARRELL, G. E., WRIGHT, J., and TREVASKIS, H.: Apparatus for controlling the operation of devices operated by fluid pressure, such as aircraft flaps (493,652).
17920. NAAMLOOZE VENNOOTSCHAP DERDE HILLEGOMSCHE MAATSCHAPPIJ TOT EXPLOITATIE VAN ONROERENDE ZAKEN: Aircraft (493,655).
20941. JAEGAR AVIATION: Radio direction-finding (493,574).
26472. NICOLLE, A. V., and AUTOMOTIVE ENGINEERING CO., LTD.: Pistons (493,664).
34583. JUNKERS FLUGZEUG-UND-MOTORENWERKE GES.: Radiators for the engines of aircraft or other vehicles (493,673).
35373. LORENZ AKT.-GES., C.: High-frequency electrical signalling systems (493,674).
2600. TINSSONNIER, G., and SOC. ANON. DES ETABLISSEMENTS C. TESTUT: Means for protecting aeroplanes and other aircraft against aerial barrages (493,812).
7646. LORENZ AKT.-GES., C.: High-frequency electrical signalling systems (493,822).
7647. LORENZ AKT.-GES., C.: Keying arrangement for transmitters employed for direction-finding purposes (493,683).
24229. BACK, W. E.: Aircraft (493,836).

(*Published November* 17, 1938.)

1523. SIEMENS APPARATE UND MASCHINEN GES.: Actuating systems for controls on aircraft (494,146).
2816. AUTOMOTIVE PRODUCTS CO., LTD., and PARKER, S. M.: Liquid-pressure control systems (494,147).
10843. LINDE AIR PRODUCTS CO.: Apparatus for desurfacing metal (494,092).
11381. VICKERS (AVIATION) LTD., and WALLIS, B. N.: Construction of wings, fuselages, or other aircraft bodies (494,233).
14412. SPERRY GYROSCOPE CO., INC.: Gunfire control devices (494,172).
11423. LISTER, H., and METROPOLITAN-VICKERS ELECTRICAL CO., LTD.: Means for mounting indicating instruments on switchboards or panels (494,017).
11474. BOULTON PAUL AIRCRAFT, LTD. (Soc. d'Applications des Machines Motrices): Method of mounting machine guns (494,304).
11643. VICKERS (AVIATION) LTD., and WALLIS, B. N.: Adjustable windscreens for use in conjunction with guns, cameras and other instruments mounted on aircraft (494,248).
11658. MICHELMORE, H. B. G.: Aerial advertising or display (494,308).
11672. QUILTER, J. R. C.: Detachable connectors for parachut harness (494,022).
11676. BARKER, G. G. (Bendix Aviation Corporation): Tran mission mechanism (494,250).
11701. REDGRAVE, K., and SCOTTISH AIRCRAFT AND ENGINEERING CO., LTD. (in liquidation): Aeroplanes and gun mountings therefor (494,256).
11704. ANDREWS, W. R., and SCOTTISH AIRCRAFT AND ENGINEERING CO., LTD. (in liquidation): Control for aircraft (494,110).
11706. ANDREWS, W. R., and SCOTTISH AIRCRAFT AND ENGINEERING CO., LTD. (in liquidation): Control devices for aircraft (494,257).
11735. MARCONI'S WIRELESS TELEGRAPH CO., LTD., and FALLOON, S. W. H. W.: Radio direction-finding installations (494,263).
11865. GRANT, C. H.: Variable-camber wings (494,177).
12806. TAYLOR, E. H.: Parachutes, parachute harness, and release mechanism (493,958).
14698. SERCK RADIATORS, LTD., and ZIMMERMANN, H. J.: Air heating or cooling apparatus (494,032).
15393. SPERRY GYROSCOPE CO., INC.: Engine-starters (494,119).
22019. ECLIPSE AVIATION CORPORATION: Engine-starting mechanism (494,046).
22283. S.U. CARBURETTER CO., LTD., and COKAYNE, R. M.: Lubrication of internal-combustion engine cylinders (494,047).
26897. GETEFO GES. FÜR TECHNISCHEN FORTSCHRITT: Mounting of seats for aircraft (494,130).
28214. OESTERREICHISCH UNGARISCHE OPTISCHE ANSTALT C.P. GOERZ GES., and RAABER, H.: Bomb sights (494,978).
28513. FRENGER, G.: Methods of and apparatus for the combustion of waste materials (493,980).
30382. LORENZ AKT.-GES., C.: Electric wave-filter systems (493,982).
5836. LINDE AIR PRODUCTS CO.: Methods of and apparatus for severing metals by fusion (494,218).
7274. SPERRY GYROSCOPE CO., INC.: Gunfire control devices (494,288).
16066. COOK, F.: Armament of aeroplanes (494,222).
29363. SIEMENS APPARATE UND MASCHINEN GES.: Actuating systems for controls on aircraft (494,291).
11642. VICKERS (AVIATION) LTD., and WALLIS, B. N.: Aircraft gun mountings (494,109).